Section 5—Final Environmental Impact Statement

APPENDIX HH FISH, CRAWFISH, AND MUSSEL SURVEY

TECHNICAL REPORT APPENDICES

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Basin, Indiana.

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APPENDIX D QHEI Forms for Eight

Streams Evaluated in the Tier 2 Section 5 Corridor, June 2005 and May 2006.

Final Report:

Fish, Unionid, and Crayfish
Community Characterization of the
I-69 Tier 2 Section 5 Corridor
Bloomington to Martinsville
Monroe to Morgan Counties, Indiana

Prepared for:

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Under Contract to:

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Indianapolis, Indiana

Prepared by:

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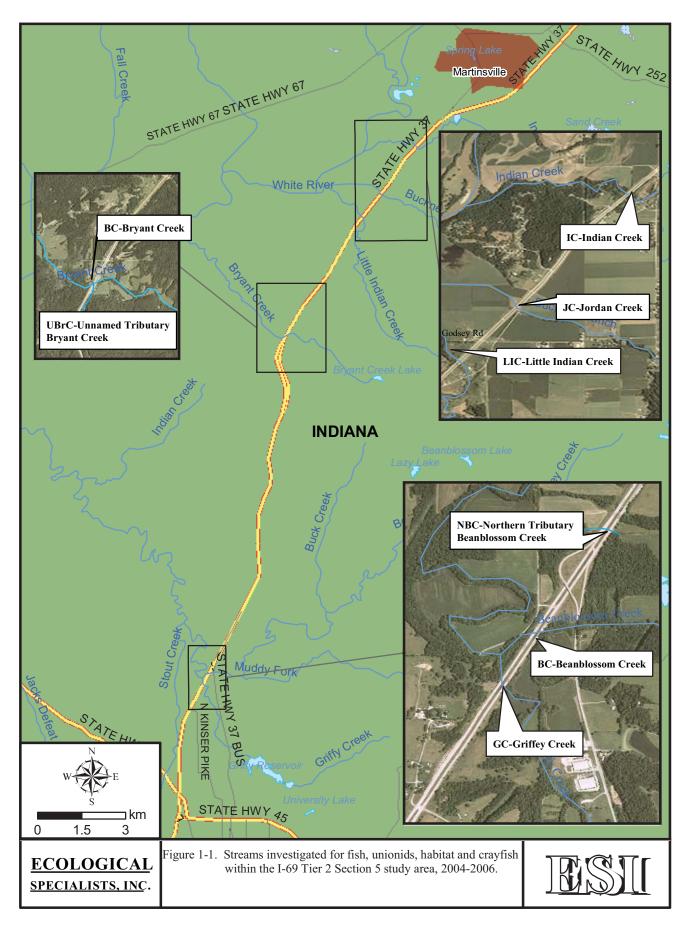
- Appendix A. Fishes of the White River Basin, Indiana.
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1.0 Introduction

Fish, unionid (freshwater mussel), and crayfish surveys were conducted as one component of investigations for the I-69 Tier 2 Section 5 project corridor. The corridor extends from Bloomington, Indiana northerly to Martinsville, Indiana and centers on the existing State Route (SR 37). Eight streams are crossed by SR 37 between the southern and northern termini of the I-69 Tier 2 study corridor; all are tributaries to the White River basin (Figure 1-1).

The White River Basin supports species-rich fish and unionid (freshwater mussel) communities. One hundred and fifty-three (153) species of fish representing 25 families have been identified in the White River Basin in Indiana (Appendix A). Of those, 13 are listed by Indiana Department of Natural Resources (IDNR) as endangered or of special concern (Table 1-1). The White River Basin historically supported 72 unionid species and 59 unionid species have been reported since 1989. Eighteen (18) unionid species are listed as endangered or special concern in Indiana and seven of these are federally-listed as endangered or are federal candidate species (see Table 1-1). These include the federally-endangered Cyprogenia stegaria, Epioblasma obliquata perobliqua, Epioblasma torulosa rangiana, Epioblasma torulosa torulosa, Pleurobema clava, and Pleurobema plenum (Appendix B). Cyprogenia stegaria, E. torulosa torulosa and P. clava are identified for the West Fork White River (Cummings et al., 1991). Of these three, the only species thought to be extant in the White River is C. stegaria (ESI, 2002; Thomas Simon, USFWS, pers. comm., 2004; Brant Fisher, Indiana DNR, pers. comm., 2004)

The purpose for this survey was to characterize the fish, mussel, and crayfish communities, describe stream habitat characteristics, report on any state or federally-listed species that may be present, and compare results of similar studies on these streams. Species of potential occurrence within the study area that are of particular interest to the U. S. Fish and Wildlife Service (USFWS) and the Indiana Department of Natural Resources (IDNR), include *Ammocrypta pellucida* (eastern sand darter), an undescribed subspecies of mud darter, *Etheostoma cf. asprigene* (Thomas Simon, pers. comm., 2004; Brant Fisher, Indiana DNR, pers. comm., 2004), and the fanshell (*C. stegaria*). The species were identified based on historical records for the project area.



June 2006 04-025

Table 1-1. Federal and state listed species of the White River Basin in Indiana, 2006.

Species ¹		Stat Federal		White River ³	West Fork White River ⁴
Mollusks					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Unionidae					
Cyprogenia stegaria	Fanshell	FE	E	X	X
		FE	E	X	Λ
Epioblasma obliquata perobliqua	White catspaw Northern riffleshell	FE	E	X	X
Epioblasma torulosa rangiana	Tubercled blossom	FE	E	X	X
Epioblasma torulosa torulosa	Snuffbox		E	X	
Epioblasma triquetra				X X	 X
Fusconaia subrotunda	Longsolid		E		
Lampsilis fasciola	Wavyrayed lampmussel		SC	X	
Obovaria subrotunda	Round hickorynut		SC	X	X
Pleurobema clava	Clubshell	\mathbf{FE}	E	X	X
Pleurobema cordatum	Ohio pigtoe		$\overset{\circ}{\text{sc}}$	X	
Pleurobema plenum	Rough pigtoe	${ m FE}$	\mathbf{E}	X	
Pleurobema rubrum	Pyrimid pigtoe		\mathbf{E}	X	X
$Ptychobrnchus\ fasciolaris$	Kidneyshell		\mathbf{SC}	X	X
$Quadrula\ cylindrica$	Rabbitsfoot		${f E}$	X	X
$Simpsonaias\ ambigua$	Salamander mussel		SC	X	
$Toxolasma\ lividus$	Purple lilliput		SC	\mathbf{X}	
$Villosa\ fabalis$	Rayed bean	FC	SC	\mathbf{X}	
Villosa lienosa	Little spectaclecase		SC	\mathbf{X}	
<u>Fishes</u>					
Acipenseridae (Sturgeons)					
Acipenser fulvescens	Lake sturgeon		${f E}$	\mathbf{X}	
Catostomidae (Suckers)	5				
Cycleptus elongatus	Blue sucker		\mathbf{SC}	\mathbf{X}	
Moxostoma carinatum	River redhorse		SC	X	
Amblyopsidae (Cavefishes)	2017 01 100110120		20		
Amblyopsis spelaea	Northern cavefish		${f E}$	X	
Fundulidae (Topminnows)	_ , , _ , _ , _ , _ , _ , _ , _ , _ , _		_		
Fundulus catenatus	Northern studfish		\mathbf{SC}	X	
Centrarchidae (Sunfish and Basses			20		
Lepmois symmetricus	Bantam sunfish		\mathbf{SC}	X	
Percidae (Perches and Darters)	Daniani Samisii			11	
Ammocrytpa pellucida	Eastern sand darter		SC	X	
Etheostoma camurum	Bluebreast darter		E	X	
Etheostoma histrio	Harlequin darter		E	X	
Etheostoma maculatum	Spotted darter	- 	E	X	-
Etheostoma tippecanoe	=		E	X	
	Tippecanoe darter		E	X	
Etheostoma variatum	Variegate darter				
Percina evides 1 Mollusk nomenclature follows Turgeon et al.	Gilt darter	va Nolaan at	E (200)	X	

¹ Mollusk nomenclature follows Turgeon *et al.* (1998); Fish nomenclature follows Nelson et al. (2004)

² Indiana DNR (2003); USFWS (2004); FE = Federally Endangered; FC = Federal Candidate; E = Endangered; SC = Special Concern ³ Cummings *et al.* (1991); Crawford *et al.* (1996) ⁴ Cummings *et al.* (1991)

2.0 Methods

Eight streams were identified within the project corridor based on aerial photography and topographic maps. These streams were investigated for fish, unionids, crayfish, and habitat: Griffey Creek (GC), Beanblossom Creek (BC), North tributary to Beanblossom Creek (NBC), Unnamed tributary to Bryant Creek (UBrC), Bryant Creek (BrC), Little Indian Creek (LIC), Jordan Creek (JC), and Indian Creek (IC) (see Figure 1-1). Preliminary investigation determined that Jordan Creek would not receive sampling for fish, crayfish, or unionids. Jordan Creek appears to be an intermittent stream and was dry at the time of review therefore only habitat was evaluated at this site. Fish and unionid sampling was conducted between 12 to 17, October 2004. Habitat evaluations, additional fish sampling on Bryant and North tributary to Beanblossom creeks, and crayfish sampling was conducted 29 to 30, June 2005. The unnamed tributary to Bryant Creek was conducted May 2006. A Qualitative Habitat Evaluation Index (QHEI) form was completed for all streams.

2.1 Fish Survey

Four of the six streams (Griffey Creek (GC), Beanblossom Creek (BC), Little Indian (LIC) and Indian Creeks (IC)) were sampled for fish using a DC-pulse tote barge electrofishing unit. Since the purpose of the survey was to characterize the fish community in terms of species composition and presence/absence of target species within the project corridor, 200m sections within the corridor were delineated in each stream. The sampling area for each stream was defined as that length of stream extending 100m downstream of the center of State Route (SR) 37 bridge to a point approximately 100m upstream of that bridge. Access to Little Indian Creek at both SR 37 and Old SR 37 bridge crossings was not possible; therefore, the stream was accessed at the Godsey Road bridge (see Figure 1-1). The stream was sampled for 200m from Godsey Road upstream to within approximately 50m of the SR 37 bridge crossing. This segment of Little Indian Creek was partially within the project corridor and similar in landuse, stream characteristics, and habitat to Little Indian Creek in the project corridor upstream of SR 37 bridge. Since the segments were similar in characteristics and in close proximity to each other, the fish communities were presumed similar.

Electrofishing began at the downstream point and continued to the upstream end. Effort expended at sites ranged from 9.6 to 21.9 electrofishing minutes. Stunned fish were collected and placed in a 19L bucket until processed. Those specimens too large for the bucket were processed immediately. Fish were identified, counted, measured for length (mm; total length for fish larger than 100mm) and weight (g). Fish smaller than 100mm were batch weighed. Those fish smaller than 100mm and/or sole representatives of a species were not weighed due to equipment limitations. Fish not readily identified in the field were preserved with 10% formalin and returned to the laboratory for identification. Laboratory specimens were not measured for length and were not weighed because of

possible preservation induced distortions (Anderson and Neumann, 1996).

Three of the streams (North Tributary to Beanblossom Creek (NBC), Bryant Creek (BrC), and unnamed tributary to Bryant Creek (UBrC)) were too small for sampling with a tote barge electrofishing unit, thus fish were sampled using a 3mm (0.125in) mesh seine (October 2004 sampling) and/or a Wisconsin battery-powered backpack electrofisher (June 2005 and May 2006 sampling). Sites were demarcated as described above. Methods ranged from kick seining in shallow, rocky, and sandy areas; dragging the seine through deeper pools; and electrofishing the entire reach (200m). Seined areas totaled approximately 50m to 70m of stream at each site. All habitats were representatively sampled. *Ammocrypta pellucida* and *E. cf. asprigene* prefer shallow sand/gravel and sluggish riffle habitats and backwater areas with organic material; therefore, efforts were concentrated in those areas. All collected fish were identified and counted as described above.

Metrics used to describe the fish community included abundance (total number of fish caught), species richness (number of species collected), catch-per-unit-effort (CPUE), evenness, and Shannon-Weiner diversity. The CPUE is the number of fish caught per unit of effort (meter or minute). Evenness represents the relative abundance of each species throughout the community in the study reach, and Shannon-Weiner diversity index measures the diversity of the study reach. Shannon Weiner diversity index collectively evaluates abundance, richness, and evenness of a site. Photodocumentation of sites is presented in Appendix C.

2.2 Unionid Survey

Because species richness is a function of the number of individuals collected, qualitative methods (freely collecting all unionids encountered) were used to characterize the unionid community at each of the six sites (Strayer and Smith, 2003). The survey area was the same as that for fish and was defined as that length of stream extending 100m downstream of the center of State Route (SR) 37 bridge to a point approximately 100m upstream of that bridge. Unsuitable habitat areas (very shallow, thick vegetation, or thick silt over substrate) were avoided. Unionids require burrowable substrate in water with sufficient flow to prevent sedimentation, but without enough flow to render the substrate unstable (Vaughn, 1997). Biologists visually and tactually searched for at least 1.5 work person hours (wph), concentrating their efforts in the highest quality habitats (clean substrates in flowing areas). All shells were collected and identified. Freshly-dead (lustrous nacre, periostracum intact, animal probably dead ≤ 1 year), weathered dead (dull, chalky nacre, periostracum heavily eroded, animal likely dead >2-3 months), and live unionids were identified, counted, measured (length in mm), and aged (external annuli count). Habitat parameters including substrate, velocity, land use, and riparian vegetation were recorded.

2.3 Crayfish Survey

Crayfish were sampled using guidance outlined in the Standard Operating Procedures for the Collection and Study of Burrowing Crayfish in Indiana (Simon, 2004). Crayfish were originally to be collected while sampling for fish; however, fish were sampled in October 2004, which is when some crayfish are inactive (Simon, 2004; Thomas Simon, pers. comm., 2004). Therefore, crayfish sampling was postponed until June 2005 and conducted in the same reaches as fish sampling. A Wisconsin battery backpack electrofishing unit was used to collect crayfish. Stunned crayfish were netted or hand collected and placed into a 19L bucket until preserved. In areas where crayfish densities were high (>100 individuals), only a representative sample was retained. All crayfish were preserved with 70% ethanol and 10% formalin solution. Crayfish samples were sent to the USFWS Bloomington Field Office for identification by Dr. Thomas Simon.

2.4 Habitat Evaluation

An Indiana Department of Environmental Management (IDEM) Qualitative Habitat Evaluation Index (QHEI) was calculated for each of the eight streams. The purpose of the QHEI (Ohio EPA, 1989) was to assess each of the sites ability to support biota (fish and macroinvertebrates). Instream habitat and surrounding land use were evaluated and six metrics were scored to obtain an overall QHEI score. The higher the score a site received the better the habitat with a maximum achievable score equaling 100. The six metrics evaluated were substrate, instream cover, channel morphology, riparian zone and bank erosion, pool/glide quality, riffle/run quality, and gradient.

3.0 Results

3.1 Fish Survey

A total of 1,412 fish representing 46 species and 11 families were collected from seven streams within the I-69 Tier 2 Section 5 corridor (Table 3-1). The catch per unit effort (CPUE) ranged from 2.9 to 22.9 fish/min and 0.8 to 3.6 fish/m. Habitat varied among sites. In general, Indian Creek, Little Indian Creek, Bryant Creek and unnamed tributary to Bryant Creek exhibited more habitat diversity and richness (i.e., riffle/run/pool sequences, variety of fish habitats, and moderate flow rates); a combination of conditions that are necessary to support a diverse fish community. Griffey Creek, Beanblossom Creek, and the North Tributary to Beanblossom Creek were generally more homogeneous in terms of habitat (little to no flow, mud/silt/sand substrate). None of the fish species identified by INDNR or USFWS as potentially occurring in the corridor (A. pellucida and E. cf. asprigene) or any other federal or state listed fish species were collected at any of the surveyed locations.

Griffey Creek

Griffey Creek was small and stream morphology differed between upstream and downstream sampling reaches near the SR 37 bridge. Water depths upstream of SR 37 averaged 0.5m and stream width averaged 4.0m. Water depths downstream averaged 1.5m deep and stream width averaged 6.0m wide. Habitat underneath the bridge and in the upstream reach was shallow and substrate consisted of sand and gravel with a few riffle/run sequences. The surveyed reach downstream of SR 37 was generally deep and habitat was homogeneous, consisting of sand and clay with steeply sloping banks. Stable substrate was virtually absent except for a few cobble/boulders just downstream of the bridge. Landuse in the area was predominantly agriculture and the riparian zone was row crop/pasture upstream of SR 37 and forested in the downstream reach.

The fish community reflected the small stream nature of the site with primarily pool species and a few riffle/run species. A total of 125 fish representing 17 species were collected from Griffey Creek (Table 3-1). The dominant species were *Lepomis humilis* (43.2%) and *Hypentelium nigricans* (12.8%). Other species present and comprising less than 10% of the total catch were *Lepomis macrochirus* (N=10), *Pimephales notatus* (N=9), *Etheostoma nigrum* (N=8), and *Cyprinella whipplei* (N=7). Eight of the 17 species were measured for length and/or weight (Table 3-2). The remaining species were either too small or returned to the laboratory for processing. The CPUE was 13.0fish/min and effort expended at this site was 9.6min. Shannon-Weiner diversity (2.90) and evenness (0.71) were moderate.

Beanblossom Creek

Water depth in Beanblossom Creek averaged 1m and stream width was approximately 10 to 15m.

Table 3-1. Fish species collected along the I-69 Tier 2 Section 5 corridor (1 of 2).

									Si	\mathbf{te}^{1}										
	(GC^2]	$\mathbf{BC^2}$	N	$^{1}BC^{2}$	NI	$3C^3$	UI	BrC ⁴	E	${f BrC^2}$	В	rC^3	I	IC^2]	\mathbb{C}^2	To	otal
Species	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Clupeidae (Herrings)																				
Dorosoma cepedianum	-	-	10	18.2%	-	-	-	-	-	-	-	-	_	-	8	4.5%	2	0.4%	20	1.4%
Cyprinidae (Carps and Minnows)																				
Campostoma pullum	-	-	-	-	-	-	-	-	4	4.4%	-	-	17	8.8%	2	1.1%	9	1.8%	32	2.3%
Cyprinella spiloptera	5	4.0%	2	3.6%	-	-	-	-	-	-	3	5.5%	_	-	-	-	243	48.5%	253	17.9%
Cyprinella whipplei	7	5.6%	-	-	-	-	-	-	-	-	-	-	_	-	-	-	47	9.4%	54	3.8%
Cyprinus carpio	-	-	1	1.8%	-	-	-	-	-	-	-	-	_	-	-	-	-	-	1	0.1%
Hybognanthus nuchalis	-	-	-	-	-	-	-	-	-	-	-	-	_	-	34	19.3%	-	-	34	2.4%
Luxilus chrysocephalus	-	-	-	-	-	-	-	-	-	-	4	7.3%	1	0.5%	5	2.8%	-	-	10	0.7%
Lythrurus umbratilis	-	-	-	-	-	-	-	-	1	1.1%	-	-	_	-	-	-	-	-	1	0.1%
Notropis atherinoides	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	-	1	0.2%	1	0.1%
Notropis blennius	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	-	1	0.2%	1	0.1%
Notropis stramineus	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	-	1	0.2%	1	0.1%
Opsopoedus emiliae	-	-	-	-	54	29.8%	-	-	-	-	-	-	_	-	-	-	-	-	54	3.8%
Phoxinus erythrogaster	-	-	-	-	-	-	-	-	-	-	-	-	15	7.8%	-	-	-	-	15	1.1%
Pimephales notatus	9	7.2%	-	-	-	-	-	-	-	-	-	-	_	-	-	-	23	4.6%	32	2.3%
Pimephales vigilax	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	-	11	2.2%	11	0.8%
Rhynichthys atratulus	-	-	-	-	-	-	-	-	2	2.2%	-	-	1	0.5%	-	-	-	-	3	0.2%
Semotilus atromaculatus	-	-	-	-	-	-	-	-	25	27.5%	25	45.5%	97	50.3%	-	-	-	-	147	10.4%
Catostomidae (Suckers)																				
Carpiodes velifer	-	-	2	3.6%	-	-	-	-	-	-	-	-	_	-	-	-	-	-	2	0.1%
Catostomus commersoni	-	-	-	-	-	-	-	-	-	-	-	-	1	0.5%	-	-	1	0.2%	2	0.1%
Erimyzon oblongus	-	-	-	-	-	-	-	-	-	-	-	-	_	-	1	0.6%	-	-	1	0.1%
Hypentelium nigricans	16	12.8%	-	-	-	-	-	-	-	-	-	-	_	-	25	14.2%	23	4.6%	64	4.5%
Minytrema melanops	1	0.8%	1	1.8%	-	-	-	-	-	-	-	-	_	-	2	1.1%	2	0.4%	6	0.4%
Moxostoma duquesnei	1	0.8%	-	-	_	-	_	-	_	-	_	-	_	-	1	0.6%	7	1.4%	9	0.6%
Moxostoma erythrurum	-	-	6	10.9%	_	-	_	-	_	-	_	-	_	-	2	1.1%	3	0.6%	11	0.8%
Ictaluridae (Bullhead Catfish)																				
Ictalurus punctatus	-	-	-	-	_	-	_	-	_	-	_	-	_	-	-	-	1	0.2%	1	0.1%
Noturus miurus	1	0.8%	_	_	-	_	_	_	_	_	_	_	_	_	_	_	_	_	1	0.1%

Table 3-1. Fish species collected along the I-69 Tier 2 Section 5 corridor (2 of 2).

									Site	1										
	G	\mathbb{C}^2	F	$3C^2$	N	\mathbf{BC}^2	NB	\mathbf{C}^3	UBı	·C ⁴	Bı	rC²	Br(J ³	L	IC^2	I	\mathbb{C}^2	To	otal
Species	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Esocidae (Pikes)																				
$Esox\ americanus$	1	0.8%	1	1.8%	-	-	4	11.4%	-	-	-	-	-	-	-	-	-	-	6	0.4%
Umbridae (Mudminnows)																				
$Umbra\ limi$	-	-	-	-	-	-	6	17.1%	-	-	-	-	-	-	-	-	-	-	6	0.4%
Poeciliidae (Livebearers)																				
Gambusia affinis	-	-	_	-	122	67.4%	25	71.4%	_	-	_	-	_	-	_	-	_	-	147	10.4%
Atherinidae (Silversides)																				
Labidesthes sicculus	1	0.8%	_	-	_	_	-	-	_	_	_	-	_	_	_	-	_	-	1	0.1%
Centrarchidae (Sunfish)																				
Lepomis cyanellus	3	2.4%	_	_	_	_	_	_	_	_	_	_	_	_	2	1.1%	_	_	5	0.4%
Lepomis humilis	54	43.2%	11	20.0%	_	_	_	_	_	_	_	_	1	0.5%	15	8.5%	20	4.0%	101	7.2%
Lepomis macrochirus	10	8.0%	17	30.9%	5	2.8%	_	_	_	_	6	10.9%	12	6.2%	38	21.6%	1	0.2%	89	6.3%
Lepomis megalotis	2	1.6%	1	1.8%	_		_	_	_	_	_	-	5	2.6%	2	1.1%	4	0.8%	14	1.0%
Lepomis microlophus	-	-	1	1.8%	_	_	_	_	_	_	_	_	_	2.070		-	1	-	1	0.1%
Lepomis punctatus	_	_		1.070	_	_	_	_	_		_	_	2	1.0%	_	_	_	_	2	0.1%
Lepomis X	1	0.8%											_	1.070	2	1.1%		_	3	0.1%
Micropterus salmoides	3	2.4%	1	1.8%											10	5.7%	11	2.2%	25	1.8%
Percidae (Perches)	9	2.470	1	1.0 %	_		_		-		-		_		10	5.1 /6	11	2.270	25	1.070
Etheostoma blennoides																	12	2.4%	12	0.8%
Etheostoma caeruleum	-	-	-	-	-	-	-	-	_	-	-	-	-	-	_	-		0.4%	2	0.0%
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2			
Etheostoma flabellare	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	1	0.2%	1	0.1%
Etheostoma nigrum	8	6.4%	-	-	-	-	-	-	-	-	4	7.3%	2	1.0%	26	14.8%	36	7.2%	76	5.4%
Etheostoma spectabile	1	0.8%	-	-	-	-	-	-	59	64.8%	13	23.6%	39	20.2%	-	-	-	-	112	7.9%
Percina maculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.6%	1	0.2%	2	0.1%
Percina sciera	1	0.8%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38	7.6%	39	2.8%
Sciaenidae (Drums)																				
Aplodinotus grunniens	-	-	1	1.8%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1%
Total	125		55		181		35		91		55		193		176		501		1412	
No. of Species ⁵ Shannon-Weiner Diversity ⁵	$\frac{17}{2.90}$		$\frac{13}{2.86}$		$\frac{3}{1.04}$		3		$\frac{5}{1.31}$		$\frac{6}{2.13}$		$\frac{12}{2.24}$		$\frac{16}{3.14}$		$\frac{25}{2.88}$		46	
Snannon-weiner Diversity Evenness ⁵	2.90 0.71		0.77		0.66		$\frac{1.14}{0.72}$		0.56		0.82		0.63		0.79		0.62		-	
Method	Electrofis	h IP	0.77 lectrofi	ch	Seine	1	0.72 Electrofish	,	0.56 Electrofish		Seine		0.65 Electrofish	, т	0.79 Electrofi	ch 1	0.62 Electrofi	ch	-	
Methou Effort (minutes shocktime or m			18.7mi		50.0m		11.5min		18.4min		70.0m	•	12.5min		11.8mi		21.9mii		-	
Catch per Unit Effort (CPUE)	13.0		2.9		3.6		3.0		4.9		0.8		15.4		15.0		22.9		_	

GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; UBrC = Unnamed tributary to Bryant Creek; BrC = Bryant Creek; LIC = Little Indian Creek; IC = Indian Creek

²October 2004 sampling event

³June 2005 sampling event

 $^{^4\,\}mathrm{May}\ 2006\ \mathrm{sampling}\ \mathrm{event}$

⁵Excludes hybrid sunfish

June 2006

Table 3-2. Average, maximum, and minimum lengths and weights for fish species measured from the I-69 Tier 2 Section 5 corridor (1 of 2).

				Max. Length	Min. Length	Avg. Length		Max. Weight	Min. Weight	Avg. Weight
Site ¹	Species		N^2	(mm)	(mm)	(mm)	N^2	(g)	(g)	(g)
	Esox americanus	Redfin pickerel	1	165.0			1	34.0		
	Hypentelium nigricans	Northern hogsucker	2	310.0	310.0	310.0	1	304.0		
	Lepomis cyanellus	Green sunfish	-				1	11.0		
GC	Lepomis humilis	Orangespotted sunfish	-				2	114.0	67.0	90.5
GC	Lepomis megalotis	Longear sunfish	2	153.0	148.0	150.5	2	93.0	60.0	76.5
	Lepomis~X	Sunfish hybrid	-				1	28.0		
	$Micropterus\ salmoides$	Largemouth bass	3			62.0	2			2.0
	$Minytrema\ melanops$	Spotted sucker	1	298.0			1	268.0		
	Aplodinotus grunniens	Freshwater drum	1	475.0			-			
	Carpiodes velifer	Highfin carpsucker	1	210.0			1	132.0		
	Cyrpinus carpio	Common carp	1	450.0			1			
	Dorosoma cepedianum	Gizzard shad	10	241.0	165.0	200.6	9	110.0	43.0	71.4
	Esox americanus	Redfin pickerel	1	115.0			-			
\mathbf{BC}	Lepomis humilis	Orangespotted sunfish	-				2	36.0	15.0	25.5
	Lepomis megalotis	Longear sunfish	1	128.0			1	40.0		
	Lepomis microlophus	Redear sunfish	1	175.0			1	85.0		
	Micropterus salmoides	Largemouth bass	1	115.0			1	13.0		
	Minytrema melanops	Spotted sucker	1	320.0			1	380.0		
	Moxostoma erythrurum	Golden redhorse	6	362.0	222.0	302.5	6	520.0	123.0	345.7
~2	Esox americanus	Redfin pickerel	4	115.0	95.0	108.0	-			
NBC ³	Gambusia affinis	Mosquitofish	25	15.0	15.0	15.0	-			
	Campostoma pullum	Central stoneroller	8	105.0	72.0	94.7	_			
	Etheostoma specatbile	Orangethroat darter	43	65.0	30.0	47.3	43			1.3
UBrC ⁴	Rhinicthys atratulus	Blacknose dace	1	60.0			-			
	Semotilus atromacultus	Creek chub	2	130.0			2	25.0	23.0	24.0
	Campostoma pullum	Central stoneroller	17	86.0	65.0	72.2	_			
	Catastomas commersoni	White sucker	1	280.0			_			
	$Etheostoma\ spectabile$	Orangethroat darter	13	44.0	32.0	39.3	_			
\mathbf{BrC}^3	Lepomis macrochirus	Bluegill	13	96.0	35.0	63.7	_			
210	Lepomis megalotis	Longear sunfish	5	120.0	90.0	105.0	_			
	Phoxinus erythrogaster	Southern redbelly dace	15	75.0	59.0	66.0	_			
	Semotilus atromaculatus	ū	25	210.0	25.0	96.8	_			

Table 3-2. Average, maximum, and minimum lengths and weights for fish species measured from the I-69 Tier 2 Section 5 corridor (2 of 2).

Site ¹	Species		\mathbb{N}^2	Max. Length (mm)	Min. Length (mm)	Avg. Length (mm)	\mathbb{N}^2	Max. Weight (g)	Min. Weight (g)	Avg. Weight
	Dorosoma cepedianum	Gizzard shad	8	230.0	115.0	164.4	8	120.0	10.0	55.1
	Erimyzon oblongus	Creek chubsucker	1	170.0	2442	***	1	42.0		
	Hybognanthus nuchalis	Mississippi silvery minnow	-				34		1222	9.9
	Hypentelium nigricans	Northern hogsucker	22	290.0	125.0	202.8	22	225.0	18.0	83.7
	Lepomis cyanellus	Green sunfish	-	777	2000		2	1000 m		31.0
LIC	Lepomis humilis	Orangespotted sunfish		277	3555 F		15	10070	II TOTA	194.0
	Lepomis megalotis	Longear sunfish	*		25552		1	42.0	***	5 = = = 5
	Lepomis X	Sunfish hybrid	2	105.0	65.0	85.0		2666		
	Micropterus salmoides	Largemouth bass	4	220.0	30.0	120.0	2	122.0	40.0	81.0
	Minytrema melanops	Spotted sucker	2	155.0	145.0	150.0	2	30.0	26.0	28.0
	Moxostoma erythrurum	Golden redhorse	2	140.0	135.0	137.5	2	20.0	20.0	20.0
	Dorosoma cepedianum	Gizzard shad	2	240.0	210.0	225.0	12	140.0	98.0	119.0
	Hypentelium nigricans	Northern hogsucker	12	265.0	75.0	121.7	7	266.0	6.0	69.3
	Lepomis humilis	Orangespotted sunfish	18	125.0	50.0	83.5	10	90.0	4.0	22.4
IC	Lepomis megalotis	Longear sunfish	4	130.0	115.0	123.8	4	50.0	30.0	39.8
	Micropterus salmoides	Largemouth bass	8	180.0	55.0	79.8	2	72.0	62.0	67.0
	Minytrema melanops	Spotted sucker	2	320.0	150.0	235.0	1	275.0	11224	(
	Moxostoma erythrurum	Golden redhorse	3	280.0	95.0	164.3	2	244.0	8.0	126.0

¹ GC = Griffey Creek; BC = Beanblossom Creek; LIC = Little Indian Creek; IC = Indian Creek; NBC = North tributary to Beanblossom Creek; BrC = Bryant Creek; UBrC = Unnamed Tributary to Bryant Creek

² N = number of individuals measured

³ June 2005 sampling only

⁴May 2006 sampling

Instream habitat appeared inferior in relation to other streams in the study corridor. Stable substrate was represented by large woody debris. Flow was minimal and substrate was predominantly silt and mud. Landuse in the immediate area was agriculture and the riparian zone was forest. An out-of-service water treatment facility was present upstream of the SR 37 bridge. The fish community reflected the poor habitat conditions and homogeneous stream morphology present in Beanblossom Creek. A total of 55 individuals representing 13 species were collected from Beanblossom Creek, however, several of these species were representative of lake or lentic habitats (see Table 3-1). The three dominant species were *L. macrochirus* (30.9%), *L. humilis* (20.0%), and *Dorosoma cepedianum* (18.2%). Eleven (11) of the species were measured for length and/or weight (see Table 3-2). The remaining species were either too small or returned to the laboratory for processing. The CPUE was 2.9fish/min and effort expended was 18.7min. Shannon-Weiner diversity (2.86) was moderate, and evenness (0.77) was good.

North Tributary to Beanblossom Creek

The North Tributary to Beanblossom Creek was pooled just underneath the SR 37 bridge. A low water dam dividing the stream was present approximately 50m upstream of the bridge. The stream was visually assessed upstream of the low water dam and it appeared to be an agricultural/farm pond with no observable inflow or outflow: the pooled area appeared to be underground seepage through the dam. Fish sampling was not conducted upstream of the low water dam due to project scope, accessibility, and habitat conditions (0.5m layer of thick mud, excessive algal growth, inundated conditions). The pooled area located at the SR 37 bridge crossing was shallow (0.5m deep) and approximately 30m wide. Substrate was sand and concrete/asphalt rip-rap with submerged aquatic vegetation. The pooled area drains into a small stream approximately 0.25m deep and 2m wide flowing for approximately 150m before disappearing or flowing subterraneously. Substrate in this portion of the stream was sand and gravel and there was little observable flow. Landuse in the area was agriculture and the riparian zone was pasture and forest.

A total of 216 fish representing five species were collected in October 2004 and June 2005 from the North Tributary to Beanblossom Creek. One hundred and eighty-one (181) individuals representing three species were collected in October 2004 (see Table 3-1). The two dominant species collected were *Gambusia affinis* (67.4%) and *Opsopoedus emiliae* (29.8%). Thirty-five (35) fish representing 3 species were collected in June 2005. The dominant species were *G. affinis* (71.4%) and *Umbra limi* (17.1%). *Opsopoedus emiliae* and *L. macrochirus* were not collected during the June 2005 sampling. *Umbra limi* and *Esox americanus* were not collected during the October 2004 sampling event. Only fish collected in the June 2005 were measured for length. Fish were not measured for weight due to equipment limitations and most of the individuals collected were returned to the laboratory for processing. A variety of gear types were used to collect fish. Seining was conducted in October 2004,

and backpack electrofishing was used in June 2005. Because gear types differed between sampling events, CPUE, abundance, Shannon-Weiner diversity, and evenness were calculated separately for each event. The CPUE of the October 2004 sampling was 3.6 fish/m and approximately 50m of the 200m stream reach was seined (effort). The CPUE of the June 2005 sampling was 3.0 fish/min and effort expended was 11.5min. Shannon-Weiner diversity was low, 1.04 and 1.14, respectively. Evenness was moderate for the October 2004 sampling (0.66) and was slightly higher for the June 2005 sampling (0.72).

Bryant Creek

Bryant Creek was a relatively small stream, water depths ranged from 0.5 to 1m and stream widths averaged 2m to 3m. Riffle/run sequences were prevalent and substrate was sand, gravel, and cobble. Flow was moderate and substrate was moderately stable (represented by cobbles and large woody debris). Landuse in the area was agriculture and the riparian zone was predominantly forest and fallow fields throughout the surveyed reach. The fish community was typical of a small stream with primarily riffle/run and headwater species.

A total of 248 fish representing 12 species were collected from Bryant Creek. Fifty-five (55) fish representing six species were collected in October 2004 and 193 fish representing 11 species were collected in June 2005 (see Table 3-1). Species collected in 2005 not collected in October 2004 included: Lepomis punctatus, Lepomis megalotis, L. humilus, Catastomus commersoni, Rhinichthys atratulus, Phoxinus erythrogaster, and Campostoma pullum. Similarly, Cyprinella spiloptera was collected in October 2004 but not in June 2005. The two dominant species collected in October 2004 and June 2005 were Semotilus atromaculatus (45.5% and 50.3%, respectively) and E. spectabile (23.6%, and 20.2%, respectively). None of the species collected in October 2004 were measured for length or weight due to equipment limitations and most of the individuals collected were returned to the laboratory for processing. Species not retained for laboratory identification and/or verification from both the 2004 and 2005 sampling events were measured for length. Weights were not taken due to equipment limitations and most of the individuals collected were returned to the laboratory for processing. Different gear types were used to collect fish; seining was employed in October 2004, and backpack electrofishing was used in June 2005. Because gear types differed between sampling events CPUE, abundance, Shannon-Weiner diversity, and evenness were calculated separately for each event. The CPUE for the October 2004 sampling was 0.8 fish/m and approximately 70m of the 200m stream reach was seined (effort). The CPUE for the June sampling event was 15.4 fish/min for 12.5min. Shannon-Weiner diversity and evenness were 2.13 and 0.82, respectively, in October 2004 and 2.24 and 0.63, respectively, in June 2005.

Unnamed Tributary to Bryant Creek

The unnamed tributary to Bryant Creek was a small stream, water depths ranged from 0.1 to 0.4m and stream widths averaged 0.5m to 2m. Riffle/run sequences were prevalent and substrate was bedrock and gravel. Flow was moderate and substrate was stable. Landuse in the area was predominantly forest and wetlands throughout the surveyed reach. The stream flows through the median that separates the north and southbound lanes of existing SR 37. The fish community was similar to Bryant Creek and species composition was typical of a small stream with primarily riffle/run and headwater species.

Ninety-one (91) fish representing five species were collected from the unnamed tributary to Bryant Creek (see Table 3-1). The dominant species collected was *E. spectabile* (64.8%). Species not retained for laboratory identification and/or verification were measured for length. Weights were taken in aggregate for the *E. spectabile*, *C. pullum*, and *S. atromaculatus* (see Table 3-2). The CPUE was 4.9 fish/min and approximately 200m of stream was electrofished in 18.4min (effort). Shannon-Weiner diversity and evenness were 1.31 and 0.56, respectively (see Table 3-1).

Little Indian Creek

Little Indian Creek was between 0.75m and 1.5m deep and approximately 3m wide. Riffle/run sequences were present at the surveyed location though not evident at the SR 37 crossing. Substrate was sand and mud with gravel and small cobble in the riffles. Stable substrate was represented by boulders, large cobbles, and large woody debris. Landuse in the area was row-crop agriculture and the riparian zone was forest and pasture.

A total of 176 fish representing 16 species were collected from Little Indian Creek. The dominant species were *L. macrochirus* (21.6%), *Hybognanthus nuchalis* (19.3%), *E. nigrum* (14.8%), and *H. nigricans* (14.2%). Seven of the species were measured for length and weight. All other species were either sole representatives and too small or returned to the laboratory for processing. The CPUE was 15.0 fish/min and effort expended was 11.8 min. The Shannon-Weiner diversity (3.14) and evenness (0.79) were moderate to high at this site.

Indian Creek

Indian Creek was between 0.25m and 2.5m deep and was between 5m and 25m wide. The deepest portions of the stream were directly underneath the SR 37 bridge (created from scour). Riffle/run sequences were well developed throughout the site, and substrate was predominantly sand and small gravel. Stable substrate was represented by large woody debris. Upstream of SR 37, Indian Creek becomes very shallow (<0.5m). Additionally, a waterline/pipe crosses the stream

approximately 20m upstream from the northbound SR 37 bridge.

A total of 501 fish representing 25 species were collected (see Table 3-1). The dominant species was *Cyprinella spiloptera* (48.5%). Other dominant species present though each comprising less than 10% of the total catch included *C. whipplei*, *Percina sciera*, *E. nigrum*, *H. nigricans*, *L. humilis*, and *Etheostoma blennioides*. The CPUE was 22.9 fish/min and effort expended at this site was 21.9 min. Shannon-Weiner diversity (2.88) and evenness (0.62) were moderate at this site. Some of the species were measured for length and weight. All others were either sole representatives, too small to be measured, or returned to the laboratory for processing.

3.2 Unionid Survey

Unionids generally occur in shallow riffle/run areas where current velocity is sufficient to prevent silt accumulation but low enough to allow substrate stability (Vaughn, 1997). Two areas with seemingly suitable unionid habitat were found within the study area (Indian Creek and Little Indian Creek). Habitat for unionids was lacking in Griffey Creek, Beanblossom Creek, North Tributary to Beanblossom Creek, Bryant Creek, and unnamed tributary to Bryant Creek due to poor stream conditions (low current velocity, substrate of bedrock, clay and/or silt, and stream size). A total of ten species (live, freshdead, wathered dead) were collected. No state or federal species were observed.

Only three live unionids, *Pyganodon grandis*, *Lampsilis cardium*, and *Strophitus undulatus*, were collected in this study (Table 3-3). In addition to the live unionids, seven other species were collected as fresh or weathered dead shells. These species include *Fusconaia flava*, *Lampsilis siliquoidea*, *Lampsilis teres*, *Lasmigona costata*, *Leptodea fragilis*, *Utterbackia imbecillis*, and *Amblema plicata*. Both the live *P. grandis* and *L. cardium* were observed at the downstream end in the riffle/pool complex in Indian Creek and were not visible at the substrate surface (only found by grubbing through the substrate). Approximately 4.5wph were spent searching for unionids at this site.

A single live *S. undulatus* was observed in Little Indian Creek at the substrate surface in June 2005 during the crayfish sampling. No other live unionids were observed at Little Indian Creek in June 2005. Approximately 1.5 wph were spent searching for unionids at this site.

Shell material collected from Beanblossom Creek represented species tolerant of a wide range of habitat conditions. Approximately 2 wph were spent visually and tactually searching for unionids. Species collected as weathered dead shells were *Amblema plicata* and *L. siliquoidea*. In addition, three fresh dead shells of *L. fragilis* were collected. No live unionids were collected.

Table 3-3. Unionid species collected from the I-69 Tier 2 Section 5 corridor.

Site*	Species		No.	L	H	W
GC	None Observed					
	Amblema plicata	Threeridge	1 WD			
BC	$Lamp silis\ siliquoidea$	Fatmucket	$2~\mathrm{WD}$			
	Leptodea fragilis	Fragile papershell	3 FD			
	Pyganodon grandis	Giant floater	1 FD			
NBC	Utterbackia imbecillis	Paper pondshell	1 FD			
UBrC	None Observed					
BrC	None Observed					
LIC	Strophitus undulatus	Creeper	1 L	51.1	30.5	19.1
	Pyganodon grandis	Giant Floater	1 L	110.0	59.0	42.2
	Fusconaia flava	Wabash pigtoe	1 WD			
	Lampsilis cardium	Plain pocketbook	1 L	89.1	74.0	47.6
IC	$Lampsilis\ siliqouidea$	Fatmucket	$2~\mathrm{WD}$			
10	Lampsilis teres	Yellow sandshell	1 WD			
	$Lasmigona\ costata$	Fluted shell	1 WD			
	Leptodea fragilis	Fragile papershell	1 FD			
	Utterbackia imbecillis	Paper pondshell	1 FD			

^{*} GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; UBrC = Unnamed tributary to Bryant Creek; BrC = Bryant Creek; LIC = Little Indian Creek; IC = Indian Creek

L = live; FD = fresh dead; WD = weathered dead

Shell material collected from the Northern tributary to Beanblossom Creek consisted of two species, *P. grandis* and *U. imbecillis* (see Table 3-3). Both of these were fresh dead shells (<1 year old) and are typically found in pond or lentic conditions. Approximately 1.5 wph were spent visually and tactually searching for unionids at this site. No live unionids were observed.

3.3 Crayfish Sampling

Only two species of crayfish were collected from the study area, *Orconectes (Gremicambarus) virilis* (Northern crayfish) and *Cambarus (Tubericambarus) polychromatus* (Paintedhand mudbug). A total of 141 crayfish were collected and all but one individual was *O. G. virilis* (Table 3-4). Bryant Creek and North tributary to Beanblossom Creek appeared to have a high density population for over 100 individuals were collected in the sampled reaches. However, only a few were retained and preserved from each of the locations. Specimens retained were representative of the entire reach sampled, size classes exhibited, and morphological characteristics observed. No crayfish were collected or observed from unnamed tributary to Bryant Creek.

3.4 Habitat Evaluation

QHEI scores varied among the eight streams evaluated. Jordan Creek had the lowest score (25) and Bryant Creek had the highest (64) (Table 3-5). Generally, the riffle/run metric scored low (≤4) among all sites whereas all other metrics were variable. QHEI forms for each site are located in Appendix D.

Table 3-4. Crayfish species collected along the I-69 Tier 2 Section 5 corridor.

Site ¹	Species	2004	2005
GC	$Or conectes\ (Gremicambarus)\ virilis$	4	9
ВС	Orconectes (Gremicambarus) virilis	2	12
NBC	Orconectes (Gremicambarus) virilis Cambarus (Tubericambarus) polychromatus	3 0	31 1
BrC	Orconectes (Gremicambarus) virilis	6	37
LIC	Orconectes (Gremicambarus) virilis	1	29
IC	Orconectes (Gremicambarus) virilis	2	4

 $^{{}^{1}}$ GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; BrC = Bryant Creek; LIC = Little Indian Creek; IC = Indian Creek; No crayfish collected or observed in UBrC.

Table 3-5. QHEI individual and overall metric scores of streams evaluated along the I-69 Tier 2 Section 5 corridor.

	$\underline{\hspace{2cm}} \mathbf{Site}^1$										
Metric	GC	BC	NBC	UBrC	BrC	LIC	JC	IC			
Substrate	1	0.5	12	16.5	17	11.5	1	15			
Instream Cover	8	8	6	7	12	8	12	8			
Channel Morphology	5	7	5	17	13.5	13	7	10			
Riparian Zone and Bank Erosion	6	6	8	8.5	4.5	7	3	9.5			
Pool/Glide Quality	8	8	2	5	9	9	0	9			
Riffle/Run Quality	0	0	0	3.5	2	4	0	4			
Gradient	6	2	0	6	6	6	2	6			
QHEI Score	34	31.5	33	63.5	64	58.5	25	61.5			

 $^{^{1}}$ GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; UBrC = Unnamed tributary to Bryant Creek; BrC = Bryant Creek; LIC = Little Indian Creek; JC = Jordan Creek; IC = Indian Creek

4.0 Discussion

Fish, unionid, and crayfish communities were evaluated for seven streams in the study corridor. Overall, landuse in the study area was agriculture (row-crop or grazing) and habitat within the surveyed streams reflected landuse effects. Most of the streams had evidence of bank sloughing, narrow or poorly developed riparian zones, and instream habitat was limited. Species richness, evenness, and diversity in study streams reflected habitat characteristics and stability. Three of the streams (downstream section of Griffey Creek, Beanblossom Creek, and North Tributary to Beanblossom Creek) were low quality, appeared channelized, had excess sediment/silt, and were uniform in morphology. The upstream section of Griffey Creek and the remaining four streams (unnamed tributary to Bryant Creek, Bryant Creek, Little Indian Creek, and Indian Creek) had complex habitat with stream meanders, a diverse fish community, and/or evidence of unionids.

This study was to determine species composition and if any of the target species identified by the USFWS and INDNR occur in the project corridor. The three species potentially occurring in the study area are Ammocrypta pellucida (eastern sand darter), an undescribed species of mud darter E. cf. asprigene, and the federal and state endangered C. stegaria (fanshell). A statewide survey of A. pellucida was initiated in 2001, and results show distribution of this species to be more widespread than originally reported (IDNR, 2002). Ammocrypta pellucida historically occurred in the West Fork White River basin as well as the Maumee, Tippecanoe, East Fork White, Wabash, and Whitewater river basins. There have been sporadic collections of A. pellucida in these drainages since the 1940's (IDNR, 2002). Habitat degradation has contributed to its decline; however, new populations have been identified in the West Fork White River (Greene County, Indiana) and the East Fork White River (Bartholomew and Jennings Counties, Indiana) (IDNR, 2002).

Ammocrypta pellucida prefers clean, sandy runs in small creeks to large rivers (Trautman, 1981; IDNR, 2002). Clean, sandy runs were present in Griffey Creek upstream of SR 37 bridge, Bryant Creek, Little Indian Creek, and Indian Creek. Indian Creek appeared the most suitable for A. pellucida based on size, preferred habitat, and fish community composition. Substrate surfaces were generally clean and species similar in trophic guild (insectivores) were also present (E. blennoides, Etheostoma caeruleum, Etheostoma flabellare, E. nigrum, Percina maculata, and P. sciera). However, no A. pellucida were collected in this study.

In addition to *A. pellucida*, an undescribed species of *E. cf. asprigene* was targeted at the request of IDNR and the USFWS. *Etheostoma cf. asprigene* differs from *E. asprigene* in morphology and habitat. Both forms have historically been found in Indiana, but they were not recognized as separate species (Collette, 1962). The subspecies is currently being described, but additional specimens are required for further study (Thomas P. Simon, pers. comm., 2004). The preferred

habitat of *E. asprigene* is sloughs and low gradient small streams and rivers rich in organic material. The subspecies *E. cf. asprigene* prefers larger rivers at tributary mouths (Thomas P. Simon, pers. comm., 2004). Habitat for *E. asprigene* was observed in Griffey Creek downstream of SR 37, Beanblossom Creek, Northern Tributary to Beanblossom Creek, Little Indian Creek, and Indian Creek. However, no *E. asprigene* or *E. cf. asprigene* were observed in any of the surveyed streams.

The federal and state listed unionid, *C. stegaria*, prefers gravel substrate in flowing waters of medium to large rivers (Parmalee and Bogan, 1998; USFWS, 1991). This habitat was present only in Indian Creek downstream of the SR 37 bridge. *Cyprogenia stegaria* was historically abundant in the White River; however, surveys conducted in 1966-1967 yielded no live individuals (Cummins *et al.*, 1991). Fresh-dead shells were observed in 1985 in Martin County, Indiana and only weathered dead shells were collected from the White River during 1989-1991 and in 2002 (Cummins *et al.*, 1991; ESI, 2002). No evidence of *C. stegaria* was found in any of the surveyed streams.

The northern crayfish (*O. G. virilis*) was collected from six of the seven streams sampled. This species is relatively common in Indiana and occurs in low gradient warm water streams with abundant cover (Simon, 2001; Pflieger, 1996). The sites where crayfish were collected in abundance (BrC and NBC) were both abundant with cover in the form of woody debris, detritus, or submerged aquatic vegetation. The paintedhand mudbug (*G. T. polychromatus*) was also collected from the project corridor. This species is newly described and is primarily a burrowing species (Thomas Simon, pers. comm., 2005).

Griffey Creek

Griffey Creek had relatively homogeneous habitat downstream of the SR 37 bridge. The QHEI score (34) reflects the lack of habitat and influence of landuse in the area. The channel was uniform in depth and width, and structure was limited to some large woody debris, root wads, and undercut banks. All of these habitats are utilized and preferred by Centrarchidae (Trautman, 1981). The fish community in Griffey Creek was species rich but both evenness and diversity were low, as the site was dominated by *L. humilis*. The few representatives of Cyprinidae and Percidae collected from this site were upstream of the SR 37 bridge crossing where habitat changed significantly; the stream became shallow, substrate was gravel and sand, and a few small riffles were present. The *Cyprinella spp*. and *Etheostoma spp*. collected from this site are generally found in flowing streams with sandy gravel substrates (Trautman, 1981). The fish community is viable for multiple age classes were observed from specimens that were measured and collected. Unlike fish that can move into and out of an area, unionids are sedentary and typically occur in stable habitat. Unionids are typically not found in channelized areas with unstable substrate (Yokely, 1976; Strayer and Ralley, 1991) and no unionids were found downstream of the SR 37 bridge. The small stream nature (fluctuating flow

conditions) of Griffey Creek most likely prevents unionid colonization.

Beanblossom Creek

Beanblossom Creek was similar to the downstream section of Griffey Creek. Griffey Creek is a major tributary to Beanblossom Creek, and the confluence of the two is within the project corridor. Just upstream of the surveyed reach is a small, low head dam as well as Lemon Lake. Similar to Griffey Creek, the low QHEI score (31.5) was indicative of the lack of habitat and influence of landuse in the area. Stable substrate in the study reach was represented solely by large woody debris and water was not flowing. Water depths were also uniform throughout the surveyed reach. The dominant species at this site are typical pool species and are generally tolerant of homogenous habitat such as those observed in Beanblossom Creek. Species collected from this site appeared to represent several year classes indicating viability within the community. Like Griffey Creek, the Centrarchidae family was dominant. Although CPUE and species richness were lower in Beanblossom Creek than in Griffey Creek, diversity and evenness were higher: fewer individuals of dominant species were collected. Centrarchidae (namely *L. humilis* and *L. macrochirus*) dominated. *Micropterus salmoides* was the only top predator collected and may have come from Lemon Lake.

Beanblossom Creek has reportedly supported a diverse fish community (Table 4-1). Gerking (1945) identifies 35 species from Beanblossom Creek in studies conducted in 1940-1942 and earlier (Eigenmann and Fordice, 1886). There appears to have been a change in diversity in that only 13 species were observed in 2004. Additionally, the number of darter species, has also decreased substantially. Historically, seven species are known from Beanblossom Creek and none were collected in 2004.

Although ideal habitat was lacking in Beanblossom Creek, unionid shells were present. Unionids are typically found in flowing waters of medium to large streams and rivers. They are particularly sensitive to pollution and modification of rivers (Stansbery, 1970, 1971; Fuller, 1974; Havlik and Marking, 1987), such as impoundment, channelization, dredging, instream construction. The resulting siltation and hydrological changes are often cited as the primary reasons for the decline of unionid species (i.e., Stansbery, 1970 and 1971; Stein, 1972; Yokley, 1976; Suloway et al., 1981; Miller et al., 1984; Williams et al., 1992; Parmalee and Hughes, 1993; Hartfield, 1993). Perhaps hosts for these species traveled upstream during high water and dropped newly-metamorphosed juveniles near the dam (Watters, 1996). The unionid species found (A.plicata, L. siliquoidea, and L. fragilis) typically tolerate a wide range of habitat conditions. Additionally, both A. plicata and L. siliquoidea can use a wide variety of fish hosts. The host for L. fragilis is limited to freshwater drum (Aplodinotus grunniens), which typically migrate upstream during spring high water events. A few tolerant unionids may be surviving in Beanblossom Creek, but conditions are unsuitable for a

sustained unionid community.

North Tributary to Beanblossom Creek

The Northern Tributary to Beanblossom Creek was primarily shallow pool with aquatic vegetation. The QHEI score (33) was low for this site, but the substrate score (12) was higher than the other low QHEI scoring streams. This can be attributed to the variety of substrates present (see Table 3-5). However, abundance and quality of substrates was lacking. Water depths were <0.5m and substrate was sand with woody debris present and submerged aquatic vegetation. Fish were abundant at this site but diversity was low; only three species were collected. There were various year classes of the fish measured during the 2005 sampling event. The non-indigenous *G. affinis*, which inhabit ponds, small pools, and marshes, and is abundant in areas with aquatic vegetation, was the dominant species. Also collected from this site was *O. emiliae*. This species was generally collected from the narrow flowing portion that drained the pooled area. *Opsopoedus emiliae* is generally found in small streams with aquatic vegetation and sandy, organic substrates (Trautman, 1981). It should be noted that this species is relatively uncommon in Indiana (Crawford *et al.*, 1996). Similar to the fish community, the unionid community was limited to species typically found in ponds and headwaters, *P. grandis* and *U. imbecillis*. However, since no live individuals and only one shell of each were collected, the site appears unsuitable for sustaining a unionid community.

Unnamed Tributary to Bryant Creek and Bryant Creek

Species richness in Bryant Creek and the unnamed tributary reflected the small stream nature of these sites. Smaller streams tend to have a more homogeneous fish community comprised of few top predators (piscivores), overall fewer species, and less biomass, primarily due to habitat limitations (Li and Li, 1996; Vannote et al. 1980; Angermeier and Schlosser, 1989). The QHEI scores (64 and 63.4) were the highest of all the streams and can be attributed to substrate, instream cover, and channel morphology (see Table 3-5). Stream morphology was typical of headwater streams and the low species richness and moderate evenness values reflected this. The fish community was dominated by small stream species such as S. atromaculatus and E. spectabile (Trautman, 1981). There were various year classes of the fish measured during the 2005 sampling event in Bryant Creek, and S. atromaculatus exhibited the greatest range in length. Only six species were found in Bryant Creek, and though similar methods were used to capture fish and more linear area of stream was seined, the CPUE compared to North Tributary of Beanblossom Creek was much lower (3.6 fish/m versus 0.8 fish/m). The fish community of these streams was comprised of species adapted to flowing conditions (darters and minnows). These streams appear too small to sustain a unionid community, as evidenced by the absence of any individuals.

Little Indian Creek

Little Indian Creek appeared to be higher quality than the aforementioned streams. The QHEI score (58.5) was moderate compared to the other streams. Little Indian Creek lacked the substrate quality and instream cover that the higher-scoring sites (Bryant and Indian creeks) received. However, Little Indian Creek scored higher for channel morphology, riparian zone, riffle/run quality and gradient than the lower QHEI scoring sites (Griffey, Beanblossom, and North Tributary to Beanblossom creeks). Habitat was more heterogeneous with developed riffle/run/pool sequences; however, it suffers from siltation and bank cutting which suggests widely fluctuating discharge. Fish species richness and abundance was similar to that observed in Griffey Creek; however, the higher quality habitat in Little Indian Creek resulted in higher fish diversity and evenness. Species varied in length and weight, exhibiting a relatively diverse fish community. Several age classes of Dorosoma cepedianum, Hypentelium nigricans, Lepomis hybrids, and Micropterus salmoides were observed indicating viable populations of these species. Both fish communities were dominated by Centrarchidae (L. macrochirus). The presence of hybridized sunfish (Lepomis sp.) may indicate some perturbation within Little Indian Creek (Barbour et al., 1999; Simon and Dufor, 1997). Additionally, members of the Cyprinidae and Catostomidae families were more abundant in Little Indian Creek than Griffey Creek, possibly due to habitat heterogeneity. Little Indian Creek appears capable of sustaining a unionid community though only one unionid was observed. Perhaps siltation and fluctuating discharges prevent a unionid community from establishing in Little Indian Creek.

Indian Creek

Indian Creek was one of the larger, higher quality streams in the study area and the QHEI score (61.5) reflected this. The relative higher quality of the stream was also reflected in the total abundance of fish, CPUE, diversity of fish, and presence of unionids. Indian Creek supported the most species rich aquatic community of all the surveyed streams due to the variety of clean substrate types and well-developed riffle/run/pool sequences. Additionally, Indian Creek was larger and most likely more hydrologically stable. Comparable in size to Beanblossom Creek, Indian Creek had 10x more individuals and twice as many species, even though effort was similar at each site. Again, these differences can be attributed primarily to habitat heterogeneity and stability.

Indian Creek presently appears to harbor a more diverse and species rich community than previously reported by Gerking (1945). Seventeen (17) species, dominated by the Cyprinids (15), were historically reported from Indian Creek; whereas 25 were collected in 2004. Similarly, only five families (three of which were represented by one species) were reported in 1940-1942 and six were observed in 2004. The shift in community and increase in diversity may be indicative of a "recovering" stream.

Though only two live unionids were observed in the project corridor ($P.\ grandis$ and $L.\ cardium$), Indian Creek may sustain a unionid community. Both unionids were burrowed beneath the substrate. Rapid decline in water temperature slows unionid metabolism decreasing movement, feeding, and respiration in water temperatures <50°F (Waller $et\ al.\ 1999$). Burrowing is typical for unionids as water temperature declines; furthermore burrowing decreases the chance of disturbance and predation.

5.0 Summary

A summary of biota and habitat characteristics for the I-69 Tier 2 Section 5 project corridor is presented in Table 5-1. Forty-six species of fish representing 11 families were observed in the project corridor. No state or federally listed species were observed. Aquatic habitat appeared better at sustaining aquatic communities in the northern end of the project corridor, specifically Bryant Creek, Little Indian Creek, and Indian Creek, all in Morgan County, Indiana. All of these streams exhibited more diverse and species rich fish communities than Griffey, Beanblossom, and North Tributary to Beanblossom creeks and the unnamed tributary to Bryant Creek. Additionally, the presence of live unionids, though not in abundance, is also indicative of the habitat quality and its ability to support a diverse aquatic ecosystem. QHEI scores demonstrated similar results in that these three streams scored higher in terms of habitat quality.

 $\underline{\text{Table 5-1.}} \ \ \underline{\text{Summary information for fishes collected in the I-69 Tier 2 Section 5 project corridor.}$

				Site	<u>e</u>			
	GC^2		\mathbf{BC}^2		NBC ²		NBC ³	
Fish								
Total Abundance	125		55		181		35	
Shannon-Weiner Diversity	2.90		2.86		1.04		1.14	
Species Richness	17		13		3		3	
Evenness	0.71		0.77		0.66		0.72	
Catch per Unit Effort ¹	13.0		2.9		3.6		3.0	
Dominant Family								
	Centrarchidae	58.4%	Centrarchidae	56.3%	Poeciliidae	67.4%	Poeciliidae	71.4%
	Cyprinidae	16.8%	Clupeidae	18.2%	Cyprinidae	29.8%	Umbridae	17.1%
Dominant Species								
	$L.\ humilus$	43.2%	L. macrochirus	30.9%	G. affinis	67.4%	G. affinis	71.4%
	H. nigricans	12.8%	$D.\ cepedianum$	18.2%	O. emiilae	29.8%	U. limi	17.1%
<u>Unionids</u>								
Present	No		Yes		Yes			
No. Live	n/a		FD/WD shells	only	FD shells of	nly		
Crayfish								
Total collected	13		14		3		32	
No. Species	1		1		1		2	
Habitat								
QHEI Score	34.0		31.5		33.0		33.0	

	<u>Site</u>											
	UBrC ⁴		BrC ²		BrC ³		LIC ²		IC ²			
Fish												
Total Abundance	91		55		193		176		501			
Shannon-Weiner Diversity	1.31		2.13		2.24		3.14		2.88			
Species Richness	5	5			12	16		25				
Evenness	0.56		0.82		0.63	0.79		0.62				
Catch per Unit Effort ¹	4.9		0.8		15.4	15.0		22.9				
Dominant Family												
	Percidae	64.8%	Cyprinidae	58.3%	Cyprinidae	67.9%	Centrarchidae	39.1%	Cyprinidae	67.1%		
			Percidae	30.9%	Percidae	21.2%	Cyprinidae	23.2%	Percidae	18.0%		
Dominant Species												
	$E.\ spectabile$	64.8%	S. atromaculatus	45.5%	S. atromaculatus	50.3%	L. macrochirus	21.6%	$C.\ spiloptera$	48.5%		
			$E.\ spectabile$	23.6%	$E.\ spectabile$	20.2%	H. nuchalis	19.3%	$C.\ whipplei$	9.4%		
Unionids												
Present	No		No				Yes		Yes			
No. Live	n/a		n/a				1		2			
<u>Crayfish</u>												
Total collected	0		6		37		30		6			
No. Species			1		1		1		1			
Habitat												
QHEI Score	63.5		64		64.0		58.5		61.5			

GC = Griffey Creek; BC = Beanblossom Creek; NBC = Northern Tributary to Beanblossom Creek; UBrC= Unnamed tributary to Bryant Creek; BR = Bryant Creek; LIC = Little Indian Creek; IC = Indian Creek

¹ CPUE = no/min for GC, BC, NBC (June), UBrC, BrC (June), LIC, and IC; CPUE = no/m for NBC (Oct) and BrC (Oct).

² October 2004 sampling effort

 $^{^{\}scriptscriptstyle 3}$ June 2005 sampling effort

 $^{^4}$ May 2006 sampling effort

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Section 5—Final Environmental Impact Statement

APPENDIX HH FISH, CRAWFISH, AND MUSSEL SURVEY

TECHNICAL REPORT APPENDICES

APPENDIX A	Fishes of the White River Basin, Indiana.
APPENDIX B	Unionids of the White River Basin Collected Since 1989.
APPENDIX C	Photodocumentation of Sites and Fish and Unionids Encountered in The I-69 Tier 2 Section 5 Corridor, October 2004 and May 2006.
APPENDIX D	QHEI Forms for Eight Streams Evaluated in the Tier 2 Section 5 Corridor, June 2005 and May 2006.

Appendix A. Fishes of the White River Basin, Indiana

Appendix A. Fishes of the White River Basin, Indiana (Crawford et al., 1996).

Appendix A. Fishes of the white it	iver Basin, marana (Crawford	Star	tus²
$Species^1$		Federal	State
Petromyzontidae (Lampreys)			
$Icthyomyzon\ castaneus$	Chestnut lamprey		
$Icthyomyzon\ fossor$	Northern brook lamprey		
$Icthyomyzon\ unicusp is$	Silver lamprey		
$Lampetra\ aepyptera$	Least brook lamprey		
$Lampetra\ appendix$	American brook lamprey		
Acipenseridae (Sturgeons)			
$A cipenser\ fulvescens$	Lake sturgeon		\mathbf{SE}
$S caphirhynchus\ platorynchus$	Shovelnose sturgeon		
Polyodontidae (Paddlefishes)			
$Polyodon\ spathula$	Paddlefish		
Lepisosteidae (Gars)			
$Lepisosteus\ oculatus$	Spotted gar		
$Lepisosteus\ osseus$	Longnose gar		
$Lepisosteus\ platostomus$	Shortnose gar		
$Lepisosteus\ spathula$	Alligator gar		
Ammidae (Bowfins)			
$Amia\ clava$	Bowfin		
Hiodontidae (Mooneyes)			
$Hiodon\ alosoides$	Goldeye		
$Hiodon\ tergisus$	Mooneye		
Anguilidae (Freshwater eels)			
$Anguilla\ rostrata$	American eel		
Clupeidae (Herrings)			
$Alosa\ chrysochloris$	Skipjack herring		
$Dorosoma\ cepedianum$	Gizzard shad		
$Dorosoma\ petenense$	Threadfin shad		
Cyprinidae (Carps and Minnows)			
$Campostoma\ pullum$	Central stoneroller		
Carassius auratus	Goldfish		
Ctenopharyngodon idella	Grass carp		
Cyprinella lutrensis	Red shiner		
$Cyprinella\ spiloptera$	Spotfin shiner		
$Cyprinella\ whipplei$	Steelcolor shiner		
$Cyprinus\ carpio$	Common carp		
$Erimystax\ dissimilis$	Streamliine chub		
$Erimystax\ x ext{-}punctatus$	Gravel chub		
$Hy bognanthus\ nuchalis$	Mississippi silvery minnow		
$Luxilus\ chrysocephalus$	Striped shiner		
$Luxilus\ cornutus$	Common shiner		
Lythrurus ardens	Rosefin shiner		
Lythrurus fumeus	Ribbon shiner		
$Ly thrurus\ umbratilis$	Redfin shiner		
${\it Macrhybopsis}\ aestivalis$	Speckled chub		
Macrhybopsis storeriana	Silver chub		
Nocomis biguttatus	Hornyhead chub		
Nocomis micropogon	River chub		
Notemigonus crysoleucas	Golden shiner		
$Notropis\ amblops$	Bigeye chub		
$Notropis\ amnis$	Pallid shiner		
Notropis anogenus	Pugnose shiner		
Notropis ariomnus	Popeye siner		

pecies ¹		Sta	
<u>- </u>	Diagon altier en	Federal	State
Notropis blennius	River shiner		
Notropis boops	Bigeye shiner		
Notropis buccatus	Silverjaw minnow		
Notropis buchanani	Ghost shiner		
Notropis chalybaeus	Ironcolor shiner		
Notropis heterodon	Blackchin shiner		
Notropis heterolepis	Blacknose shiner		
Notropis hudsonius	Spottail shiner		
Notropis photogenis	Silver shiner		
Notropis rubellus	Rosyface shiner		
$Notropis\ shumardi$	Silverband shiner		
Notropis stramineus	Sand shiner		
Notropis texanus	Weed shiner		
Notropis volucellus	Mimic shiner		
Notropis wickliffi	Channel shiner		
$Op sopoed us\ emiliae$	Pugnose minnow		
Phenacobius mirabilis	Suckermouth minnow		
Phoxinus erythrogaster	Southern redbelly dace		
$Pimephales\ notatus$	Bluntnose minnow		
Pimephales promelas	Fathead minnow		
$Pimephales\ vigilax$	Bullhead minnow		
$Rhinichthys\ atratulus$	Blacknose dace		
$Semotilus\ atromaculatus$	Creek chub		
atostomidae (Suckers)			
$Carpiodes\ carpio$	River carpsucker		
$Carpiodes\ cyprinus$	Quillback		
Carpiodes velifer	Highfin carpsucker		
$Catostomus\ commersoni$	White sucker		
Cycleptus elongatus	Blue sucker		SC
$Erimyzon\ oblongus$	Creek chubsucker		
Hypentelium nigricans	Northern hog sucker		
Ictiobus bubalus	Smallmouth buffalo		
Ictiobus cyprinellus	Bigmouth buffalo		
Ictiobus niger	Black buffalo		
Lagochila lacera	Harelip sucker		
Minytrema melanops	Spotted sucker		
Moxostoma anisurum	Silver redhorse		
$Moxostoma\ carinatum$	River redhorse		SC
Moxostoma duquesnei	Black redhorse		
Moxostoma erythrurum	Golden redhorse		
Moxostoma macrolepidotum	Shorthead redhorse		
etaluridae (North American catf			
Ameiurus catus	White catfish		
Ameiurus melas	Black bullhead		
Ameiurus natalis	Yellow bullhead		
Ameiurus nebulosus	Brown bullhead		
Ictalurus furcatus	Blue catfish		
Ictalurus punctatus	Channel catfish		
Noturus eleutherus	Mountain madtom		
Noturus eteutnerus Noturus exilis	Slender madtom		
Noturus exiiis Noturus flavus	Stonecat		
•			
Noturus gyrinus	Tadpole madtom Brindled madtom		

$Species^1$		Sta Federal	tus² State
Esocidae (Pikes)			
$Esox\ americanus\ vermiculatus$	Grass pickerel		
Umbridae (Mudminnows)			
$Umbra\ limi$	Central mudminnow		
Aphredoderidae (Pirate perches)			
Aphredoderus sayanus	Pirate perch		
Gadidae (Cods)	_		
$Lota\ lota$	Burbot		
Amblyopsidae (Cavefishes)			
Amblyopsis spelaea	Northern cavefish		\mathbf{SE}
Fundulidae (Topminnows)			
Fundulus catenatus	Northern studfish		SC
Fundulus dispar	Starhead minnow		
Fundulus notatus	Blackstripe topminnow		
Fundulus olivaceus	Blackspotted topminnow		
Poeciliidae (Livebearers)			
Gambusia affinis	Western mosquitofish		
Atherinidae (Silversides)	-		
Labides the sicculus	Brook silverside		
Gasterosteidae (Sticklebacks)			
Culaea inconstans	Brook stickleback		
Corridae (Sculpins)			
$Cottus\ bairdi$	Mottled sculpin		
$Cottus\ carolinae$	Banded sculpin		
Percichthyidae (Temeperate basses	-		
Morone chrysops	White bass		
Mornone mississippiensis	Yellow bass		
Morone saxatilis	Striped bass		
Centrarchidae (Sunfish)	P		
Ambloplites rupestris	Rock bass		
Centrarchus macropterus	Flier		
Lepomis cyanellus	Green sunfish		
Lepomis gibbosus	Pumpkinseed		
Lepomis gulosus	Warmouth		
Lepomis humilis	Orangespotted sunfish		
Lepomis macrochirus	Bluegill		
Lepomis megalotis	Longear sunfish		
Lepomis microlophus	Redear sunfish		
Lepomis punctatus	Spotted sunfish		
Lepmois symmetricus	Bantam sunfish		SC
Micropterus dolomieu	Smallmouth bass		
Micropterus punctulatus	Spotted bass		
Micropterus salmoides	Largemouth bass		
Pomoxis annularis	White crappie		
Pomoxis nigromaculatus	Black crappie		
Percidae (Perches)	Diack crappie	- 	
Ammocrypta clara	Western sand darter	_	
= =	Eastern sand darter		SC
Ammocrytpa pellucida	Mud darter		SC
Etheostoma asprigene Etheostoma blennoides	Greenside darter		
Etheostoma olennolaes Etheostoma caeruleum	Rainbow darter		
ынеовюта саегиеит	nampow uarter		
$Etheostoma\ camurum$	Bluebreast darter		\mathbf{SE}

June 2006

G . 1		Sta	tus^2
Species ¹		Federal	State
Etheostoma fusiforme	Swamp darter		
$Etheostoma\ gracile$	Slough darter		
$Etheostoma\ histrio$	Harlequin darter		\mathbf{SE}
$Etheostoma\ maculatum$	Spotted darter		\mathbf{SE}
$Etheostoma\ micrperca$	Least darter		
Etheostoma nigrum	Johnny darter		
$Etheostoma\ spectabile$	Orqngethroat darter		
$Ethe ostoma\ tippe canoe$	Tippecanoe darter		\mathbf{SE}
$Etheostoma\ variatum$	Variegate darter		\mathbf{SE}
$Perca\ flavescens$	Yellow perch		
Percina caprodes	Logperch		
$Percina\ copelandi$	Channel darter		
Percina evides	Gilt darter		\mathbf{SE}
$Percina\ maculata$	Blackside darter		
$Percina\ phoxocephala$	Slenderhead darter		
Percina sciera	Dusky darter		
$Percina\ shumardi$	River darter		
Stizostedion canadense	Sauger		
$Stizostedion\ vitreum$	Walleye		
Sciaenidae (Drums)			
Aplodinotus grunniens	Freshwater drum		

¹Nomenclature follows Nelson *et al.*, 2004 ² Indiana DNR (2004); USFWS (2004); SE = State Endangered; SC = State Special Concern

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Appendix B. Unionids of the White River Basin reported since 1989.

Appendix B. Unionids of the White River Basin reported since 1989 (Cummings et al., 1991)

Species ¹		Stat Federal		White River	West Fork White River
Unionidae					
Ambleminae					
Amblema plicata	Throwides			X	X
•	Threeridge			X	X
Cyclonaias tuberculata	Purple wartyback				
Elliptio crassidens	Elephant ear			X	 V
Elliptio dilatata	Spike			X	X
Fusconaia ebena	Ebonyshell			X	
Fusconaia flava	Wabash pigtoe			X	X
Fusconaia subrotunda	Longsolid		\mathbf{SE}	X	X
Megalonaias nervosa	Washboard			X	X
Pleurobema clava	Clubshell	\mathbf{FE}	\mathbf{SE}	X	\mathbf{X}
$Pleurobema\ cordatum$	Ohio pigtoe		SC	X	
Pleurobema plenum	Rough pigtoe	${ m FE}$	\mathbf{SE}	X	
$Pleurobema\ rubrum$	Pyrimid pigtoe		\mathbf{SE}	X	X
$Pleurobema\ sintoxia$	Round pigtoe			X	\mathbf{X}
$Quadrula\ cylindrica$	Rabbitsfoot		\mathbf{SE}	X	X
Quadrula metanevra	Monkeyface			X	
$Quadrula \ nodulata$	Wartyback			\mathbf{X}	
Quadrula pustulosa	Pimpleback			X	X
$\stackrel{\circ}{Q}uadrula\stackrel{\circ}{q}uadrula$	Mapleleaf			X	X
Tritogonia verrucosa	Pistolgrip			X	X
Anodoninae	BF				
Alasmidonta marginata	Elktoe			X	
Alasmidonta viridis	Slippershell mussel			X	
$Anodonta\ suborbiculata$	Flat floater			X	
Anodontoides ferussacianus	Cylindrical papershell			X	
Arcidens confragosus	Rock pocketbook			X	
Lasmigona complanata	White heelsplitter			X	X
Lasmigona compressa	Creek heelsplitter			X	Λ
	Fluted shell			X	X
Lasmogona costata	Giant floater			X	X
Pyganodon grandis				X	
Simpsonaias ambigua	Salamander mussel		SC		 V
Stophitus undulatus	Creeper			X	X
Utterbackia imbecillis	Paper pondshell			X	
Lampsillinae	20.0			37	37
Actinonaias ligamentina	Mucket			X	X
Cyprogenia stegaria	Fanshell	\mathbf{FE}	\mathbf{SE}	X	X
Ellipsaria lineolata	Butterfly			X	
Epioblasma o. perobliqua	White catspaw	$_{}^{\mathrm{FE}}$	SE	X	
Epioblasma t. rangiana	Northern riffleshell	\mathbf{FE}	\mathbf{SE}	X	X
$Epioblasma\ t.\ torulosa$	Tubercled blossom	\mathbf{FE}	\mathbf{SE}	X	\mathbf{X}
$Epioblasma\ triquetra$	Snuffbox		\mathbf{SE}	X	
$Lampsilis\ cardium$	Plain pocketbook			X	\mathbf{X}
$Lampsilis\ fasciola$	Wavyrayed lampmussel		SC	X	
$Lampsilis\ ovata$	Pocketbook			\mathbf{X}	X
$Lampsilis\ siliquoidea$	Fatmucket			X	X
Lampsilis teres	Yellow sandshell			X	X
Leptodea fragilis	Fragile papershell			X	X
Ligumia recta	Black sandshell			X	X
Obliquaria reflexa	Threehorn wartyback			X	X

		Stat	us^2	White	West Fork
Species ¹		Federal	State	River	White River
Obovaria olivaria	Hickorynut			X	X
Obovaria retusa	Ring pink			X	X
$Obovaria\ subrotunda$	Round hickorynut		SC	X	X
Potamilus alatus	Pink heelsplitter			X	
Potamilus ohiensis	Pink papershell			X	X
Ptychobranchus fasciolaris	Kidneyshell		SC	X	X
Toxolasma lividus	Purple lilliput		SC	X	
Toxolasma parvus	Lilliput			X	
Truncilla donaciformis	Fawnsfoot			X	X
Truncilla truncata	Deertoe			X	X
Villosa fabalis	Rayed bean	FC	SC	X	
Villosa iris	Rainbow			X	
Villosa lienosa	Little spectaclecase		SC	X	

Vittosa tienosa Elittle spectaclecase --- SC X --
1 Mollusk nomenclature follows Turgeon et al. (1998)
2 Indiana DNR (2004); USFWS (2004); FE = Federally Endangered; FC = Federal Candidate; SC = Special Concer SE = State Endangered

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- Appendix C. Photodocumentation of sites and fish and unionids encountered in the I-69 Tier 2 Section 5 corridor, October 2004.
- Photograph 1. Representative view of Indian Creek at SR 37 bridge looking downstream.
- Photograph 2. Representative view of Indian Creek at SR 37 bridge looking upstream.
- Photograph 3. Representative view of Little Indian Creek at Godsey Road bridge looking upstream.
- Photograph 4. Representative view of Little Indian Creek at Godsey Road bridge looking downstream.
- Photograph 5. Representative view of Griffey Creek looking upstream from confluence with Beanblossom Creek.
- Photograph 6. Representative view of Beanblossom Creek looking downstream from SR 37 bridge crossing.
- Photograph 7. Representative view of North tributary to Beanblossom Creek at SR 37 bridge crossing looking upstream.
- Photograph 8. Representative view of North tributary to Beanblossom Creek at SR 37 bridge crossing looking downstream.
- Photograph 9. View of levee and farm pond upstream of North tributary to Beanblossom Creek (east of SR 37 bridge crossing).
- Photograph 10. Representative view of Bryant Creek upstream of SR 37 bridge crossing.
- Photograph 11. Representative view looking downstream of unnamed tributary to Bryant Creek.
- Photograph 12. Representative view looking upstream of unnamed tributary to Bryant Creek.
- Photograph 13. Representative view of sunfish species collected from I-69 Tier 2 Section 5 corridor.
- Photograph 14. Representative view of unionid mollusks collected from I-69 Tier 2 Section 5 corridor.



Photograph 1. Representative view of Indian Creek at SR 37 bridge looking downstream.



Photograph 2. Representative view of Indian Creek at SR 37 bridge looking upstream.



Photograph 3. Representative view of Little Indian Creek at Godsey Road bridge looking upstream.



Photograph 4. Representative view of Little Indian Creek at Godsey Road bridge looking downstream.



Photograph 5. Representative view of Griffey Creek looking upstream from confluence with Beanblossom Creek.



Photograph 6. Representative view of Beanblossom Creek looking downstream from SR 37 bridge crossing.



Photograph 7. Representative view of North tributary to Beanblossom Creek at Sr 37 bridge crossing looking upstream.



Photograph 8. Representative view of North tributary to Beanblossom Creek at SR 37 bridge crossing looking downstream.



Photograph 9. View of levee and farm pond upstream of North tributary to Beanblossom Creek (east of SR 37 bridge crossing).



Photograph 10. Representative view of Bryant Creek upstream of SR 37 bridge crossing.



Photograph 11. Representative view looking downstream of unnamed tributary to Bryant Creek.



Photograph 12. Representative view looking upstream of unnamed tributary to Bryant Creek.



Photograph 13. Representative view of sunfish species collected from I-69 Tier 2 Section 5 corridor.



Photograph 14. Representative view of unionid mollusks collected from I-69 Tier 2 Section 5 corridor.

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Appendix D. QHEI forms for seven streams evaluated in the Tier 2 Section 5 corridor

Five QHEI scores included in the following appendix were updated based upon current scoring methodology or recent field reviews. Revised QHEI forms are attached at the end of this document. The remaining QHEI scores did not change.

semple# bloSample#	Stream Name	Location	
	! Indian- Creek	05	R37 bridge.
Surveyor Sample Date Count			QHEI Score: 70
	FGAN	Complete	t-wall
I-Substrate (20 points	Manufacture and the second		Substrate Score:
Check 1 Predominant Poel			only 1, or check 2 and AVERAGE
Check all that are present	P=Pool, R=Riffle	The second secon	bstrate Origin
Predominant Present	Predominant Present	Company State Control of the Control	lardpan(0) Lacustrine(0)
PR	PR PR	3750 Will Warman	andstone(0) Shale(4)
Bidrs/Slabs/10)	Hardpan(4)		lip/Rap(0) Coal fines(-2)
Boulders(9)	Detritus(3)	Silt Cover Silt heavy(-2)	Extensive(-2)
VSGravel(7)	() (Silv(2)	Silt moderate(-1)	Nistoderate(-1)
☑ Sand(6)	Sludge(1)	Sitt normal(0)	Low/Normal(0)
□□Bedrock(5) □□□	□□Artificiato) ☑☑	Silt free(1)	None(1)
IOTE: ignore sludge originating		10-7-10-80 FO 10-40-87	420000000
ources; score based on natural		13 +1 -1 =16	
2-Instream Cover (20 p	ointe mavimum	Telle and a fell and a	Landania Carros Carros III
A STATE OF THE PARTY OF THE PAR	Jonas maximum	\$20000 A	Instream Cover Score:
Type (check ALL that apply)	72		(check only 1, or 2 and AVERAG
Ondercut banks(1)	Deep pools(2) Oxtoo		Extensive >75% (11)
Overhanging vegetation[1]	[THE R. P. LEWIS CO. S. C. L.	c macrophytes(1)	Moderate 25-75% (7)
		and woody debris(1)	☐Sparse 5-25% (3) ☐ Nearty absent <5% (1)
-Channel Morphology	(20) (check only one per cal	tegory, OR two and AVERAGE	Channel Score: []
Sinustry Development	Channelization	Stability Modi	fications/Other
High (4) Excellent	(7) [None (6)	☐ High (3) ☐ Sr	naggingimpound
Moderate (3) Good (5)	PRecovered (4)		elocationIslands
☑Low (2) ☐Fair (3)	Recovering (3)	A CONTRACTOR OF THE PARTY OF TH	mopy Removal Leveed
□None (1) □Poor (1)	Recent or no recovery	y (1) 🗆 🗆 Dr	redging Bank shapi
		1 46.00	
omments:		O _r	ne side channel modifications
	k Erosion (10 points i	107	
		maximum)	Riparian Score: 9
I-Riparian Zone & Ban Laft/Right banks looking dow	nstream (For each category, ch	maximum) eck only one per bank, OR by	Riparian Score: 9
I-Riparian Zone & Ban Laft/Right banks looking dow		maximum) eck only one per bank, OR by y (past 100 it Riparian)	Riparian Score: 9, per bank and AVERAGE).
Left/Right banks looking dow Riperian width	nstream (For each category, chi roslowRunoff-Floodplain quality	maximum) eck only one per bank, OR by y (past 100 it Riparian)	Riparian Score: 9, o per bank and AVERAGE). Bank Erosion L. R. (per bank)
Left/Right banks looking dow Riparian width L R (per bank) L Wide >50m (4) Moderate 10-50m (3)	nstream (For each category, ch roslon/Runoff-Floodplain quality R (most predominant per bar	maximum) eck only one per bank, OR bw y (past 100 ft Riparian) ik) L. R.	Riparlan Score: 7 per bank and AVERAGE) Bank Erosion L R (per bank) llage (1) None or little (3 ial (0) Moderate (2)
Left/Right banks looking dow Riperian width L R (per bank) L Wide >50m (4)	nstream (For each category, chiroslon/Runoff-Floodplain quality R (most predominant per bar	maximum) eck only one per bank, OR by (past 100 ft Riparian) ik) L R Conservation Til Urban or Industr (1) Mining, Constru	Riparlan Score: 7, o per bank and AVERAGE). Bank Erosion L R (per bank) liage (1) None or little (3 ist (0) Moderate (2) ction (0) Heavy/Severe (
Laft/Right banks looking dow Riparian width L R (per bank) L Mide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1)	nstream (For each category, chiroslon/Runoff-Floodplain quality R (most predominant per bar Greet, Swamp (3) Shrub or Old field (2) Residential, Park, New field Fenced pasture (1)	maximum) eck only one per bank, OR hwo y (past 100 ft Riparian) ik) L R Conservation Til Urban or Industr	Riparlan Score: 9, o per bank and AVERAGE). Bank Erosion L. R. (per bank) lage (1) None or little (2) ial (0) Moderate (2) ction (0) Heavy/Severe (
Left/Right banks looking dow Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2)	nstream (For each category, chiroslon/Runoff-Floodplain quality R (most predominant per bar Greet, Swamp (3) Shrub or Old field (2) Residential, Park, New field Fenced pasture (1)	maximum) eck only one per bank, OR by (past 100 ft Riparian) ik) L R Conservation Til Urban or Industr (1) Mining, Constru	Riparlan Score: 9, o per bank and AVERAGE). Bank Erosion L. R. (per bank) lage (1) None or little (2) ial (0) Moderate (2) ction (0) Heavy/Severe (
Laft/Right banks looking dow Riparian width L R (per bank) L Mide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1)	nstream (For each category, cheroslon/Runoff-Floodplain quality R (most predominant per bar Forest, Swamp (3) Shrub or Old fleid (2) Residential, Park, New field Fenced pasture (1)	maximum) eck only one per bank, OR by (past 100 ft Riparian) ik) L R Conservation Til Urban or Industr (1) Mining, Constru	Riparlan Score: 7, o per bank and AVERAGE). Bank Erosion L R (per bank) liage (1) None or little (3 ist (0) Moderate (2) ction (0) Heavy/Severe (
Riparian Zone & Ban Left/Right banks looking dow Riparian width L R (per bank) L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comment	nstream (For each category, cheroslon/Runoff-Floodplain quality R (most predominant per bar Forest, Swamp (3) Shrub or Old fleid (2) Residential, Park, New field Fenced pasture (1)	maximum) eck only one per bank, OR two y (past 100 ft Riparian) ik) L R Conservation Til Urban or Industr (1) Mining, Constru	Riparian Score: 7 per bank and AVERAGE) Bank Erosion L R (per bank) liage (1) None or little (3 iat (0) Moderate (2) ction (0) Heavy/Severe (5 overop (0)
Riparian Zone & Ban Left/Right banks looking dow Riparian width L R (per bank) L R (per bank) Wide >50m (4) Wide >50m (4) Wide >50m (2) Very narrow <5m (1) None (0) Comment	nstream (For each category, cheroslon/Runoff-Floodplain quality R (most predominant per bar Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field Fanced pasture (1) s:	maximum) eck only one per bank, OR two y (past 100 ft Riparian) ik) L R	Riparian Score: 7 per bank and AVERAGE) Bank Erosion L R (per bank) liage (1) None or little (3 iat (0) Moderate (2) ction (0) Heavy/Severe (5 overop (0)
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Riparian Zone & Ban Left/Right banks looking dow Riparian width L R (per bank) L R (per bank) Wide >50m (4) Wide >50m (3) Namow 5-10m (2) None (0) Comment Sa-Pool/Glide Quality (Max pool depth (check one) >1m (6)	nstream (For each category, cheroslon/Runoff-Floodplain quality R (most predominant per bar Forest, Swamp (3) Residential, Park, New field Fenced pasture (1) 12 points maximum Morphology (check only on OR check two and AVERAG	maximum) eck only one per bank, OR hwy (past 100 ft Riparian) ik) L R	Riparlan Score: 7 p per bank and AVERAGE). Bank Erosion L R (per bank) liage (1) None or little (3 ist (0) Moderate (2) ction (0) Heavy/Severe (5 owerop (0) Pool/Glide Score: 7 ent velocity (check all that apply
Riparian Zone & Ban Laft/Right banks looking dow Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Namow 5-10m (2) Very narrow <5m (1) None (0) Comment ia-Pool/Glide Quality (Max pool depth (check one) >1m (6) -0.7-1m (4)	nstream (For each category, cheroslon/Runoff-Floodplain quality R (most predominant per bar Forest, Swamp (3) Shrub or Old fleid (2) Residential, Park, New field Fenced pasture (1) S: 12 points maximum Morphology (check only on OR check two and AVERAG	maximum) eck only one per bank, OR law y (past 100 ft Riparian) ik) L R	Riparlan Score: 7 per bank and AVERAGE). Bank Erosion L R (per bank) liage (1) None or little (3 iat (0) Moderate (2) ction (0) Heavy/Severe (5) ent velocity (check all that apply Torrential (-1) Interstitial (-1)
-Riparian Zone & Ban Laft/Right banks looking dow Riparian width L R (per bank) Wide>50m (4) Wide>50m (4) Wide>50m (2) Wide>50m (2) Wide>510m (2) Comment a-Pool/Glide Quality (Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1)	nstream (For each category, cheroslon/Runoff-Floodplain quality R (most predominant per bar Forest, Swamp (3) Residential, Park, New field Fenced pasture (1) 12 points maximum Morphology (check only on OR check two and AVERAG Pool width > riffle width (1)	maximum) eck only one per bank, OR law y (past 100 ft Riparian) ik) L R	Riparlan Score: 7 per bank and AVERAGE). Bank Erosion L R (per bank) liage (1) None or little (3 ial (0) Moderate (2) ction (0) Heavy/Severe (5) werrop (0) Pool/Glide Score: 7 ent velocity (check all that apply Torrential (-1) Intermittent (-2)
-Riparian Zone & Banks looking down Riparian width E R. (per bank) L. R. (per ba	nstream (For each category, cheroslon/Runoff-Floodplain quality R (most predominant per bar Forest, Swamp (3) Shrub or Old fleid (2) Residential, Park, New field Fenced pasture (1) S: 12 points maximum Morphology (check only on OR check two and AVERAG Pool width > riffle width (1) Pool width < riffle width (1)	maximum) eck only one per bank, OR hwy (past 100 ft Riparian) ik) L R	Riparlan Score: 7 per bank and AVERAGE). Bank Erosion L R (per bank) liage (1) None or little (3 iat (0) Moderate (2) ction (0) Heavy/Severe (5) werrop (0) Pool/Glide Score: 7 ent velocity (check all that apply Tomential (-1) Intermittent (-2) No pool (0)
Left/Right banks looking dow Riparian width L R (per bank) Wide >50m (4) Wide >50m (4) Wide >50m (2) Wide >51m (2) Comment Sa-Pool/Glide Quality (Max pool depth (check one) >1m (6) 0.7-1m (4) 0.2-0.4m (1) co.2m (pool=0) Com b-Riffle/Run Quality (4)	nstream (For each category, cheroslon/Runoff-Floodplain quality R (most predominant per bar Forest, Swamp (3) Residential, Park, New field Fenced pasture (1) : 12 points maximum Morphology (check only on OR check two and AVERAG Pool width > riffle width (1) Pool width < riffle width (1) ments:	maximum) eck only one per bank, OR two y (past 100 ft Riparian) ik) L R	Riparlan Score: 7 par bank and AVERAGE). Bank Erosion L. R. (per bank) liage (1)
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rveyot Sample Date	County		lacro Sample?		abitat	The state of the s	Score: 60	3
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npacts/Miscella	neous				F 14 2		-	
Major Suspected Imp	acts (Check	all that apply)	1	Misc	ellaneous QHI	II Information		
☐None	Suburt		Subjectiv	re rating (1-10):	1/2 % RH	in: Do is read	h representative	/
☐ Industrial ☐ WWTP	Channe	elization in Removal	Aesthet	ic rating (1-10):		ins 30 of stre	am7 Tug	
Agricultural	The state of the s	n rognoval Iteration	Canopy C	over (% Open):		CLASS CANADA	0	
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Urban Runoff	Natura		100	on man	10	A.		1
ollution Impact Comm	ints:			47.000			1.5	
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Substrate (20 points maximum) Predominant Predominant Present Treatment Substrate Origin Substrate Substrate Origin Substrate	· Pandoy / Pala
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Substrate (20 points maximum) Substrate Check at Predominant Pool & 1 Predominant Pool & 1 Predominant Pool & 1 Predominant Present Predominant Present Predominant Present Present Predominant Present Presen	Score: 33
Check all that are present Predominant Present Utimestone(1) Hardpan(0) Riprap(0) Silt cover Silt cover Silt cover Silt cover Silt heavyl, 2) Silt heavyl, 2) Silt heavyl, 2) Silt normal(0) Silt normal(2) Solt normal(2) Silt normal(2) Silt normal(2) Silt normal(2) Silt norma	ite Score: 17
Predominant Present Predominant Present Predominant Present PR	and AVERAGE)
P R	
BidreySlabe(10)	Lacustrine(0)
Boulders(9)	Shale(-1)
Gobble(8)	Coal fines(-2)
Grave(7) Silit(2) Silit moderate(-1) Moderate(-1) Silit moderate(-1) Moderate(-1) Silit moderate(-1) Silit moderate(-1) Silit moderate(-1) Silit moderate(-1) Silit moderate(-1) Sparse f-2 Amount (check only one per bank and AVERAGE) Chammals and AVERAGE(-1) Sparse f-2 Amount (check only one per bank, OR two per bank and Sparse f-2 Amount (check only one per bank, OR two per bank and Sparse f-2 Amount (check only one per bank, OR two per bank and Sparse f-2 Amount (check only one per bank, OR two per bank and Sparse f-2 Amount (check only one per bank, OR two per bank and Sparse f-2 Amount (check only one per bank) Recent or no recovery (t) Conservation Tillage (t) Sparse f-2 Amount (check only one per bank, OR two per bank and Sparse f-2 Amount (check only one per bank) Recent or Old field (2) Sparse f-2 Amount (check only one per bank) Sparse f-2 Amount (check	eddedness
Sand(6)	ensive(-2)
Bedrock(5)	derate(-1)
NOTE: Ignore studge originating from point sources; score based on natural substrates Comments:	
Comments: Comm	HOT # 1
Type (check ALL that apply)	AND ARREST
Undercut banks(1)	ver Score: 6
Shallowe(in slow water)(1)	r 2 and AVERAGE
Shallowe(in slow water)(1) Doulders(1) Logs and woody debris(1) Sparse 5-2 Rectmats(1) Comments:	
Recomments: Nearly about	
3-Channel Morphology (20) (check only one per category, OR two and AVERAGE) Sanuosity Development Channelization Stability Modifications/Other High (4) Excellent (7) None (6) High (3) Snagging Moderate (3) Good (5) Recovered (4) Moderate (2) Relocation Low (2) Fair (3) Recovering (3) Low (1) Canopy Removal None (1) Poor (1) Recent or no recovery (1) Dredging Comments: Recent or no recovery (1) Dredging Comments: Recent or no recovery (1) Repair (1) Re	
Sinuosity Development Channelization Stability Medifications/Other High (4)	ant <5% (1)
High (4)	inel Score: 5
Moderate (3)	12-276-05-0106-20
Low (2)	☐ Impound
Poor (1) Poor (1) Recent or no recovery (1) One side channel	Islands
A-Riparian Zone & Bank Erosion (10 points maximum) Left/Right banks looking downstream (For each category, check only one per bank, OR two per bank and A Riparian width Erosion/Runoff-Floodplain quality (past 100 ft Riparian) Ban L R (per bank) L R (most predominant per bank) Ban L R (per bank) Shrub or Old field (2) Moderate 10-50m (3) Residential, Park, New field (1) Wery narrow <5m (1) Fenced pasture (1) Max peol depth (check one) Max peol depth (check one)	Leveed
4-Riparian Zone & Bank Erosion (10 points maximum) Left/Right banks looking downstream (For each estegory, check only one per bank, OR two per bank and A Riparian width Erosion/Runoff-Floodplain quality (past 100 ft Riparian) Ban L R (per bank) Riparian width Erosion/Runoff-Floodplain quality (past 100 ft Riparian) Ban L R (per bank) Riparian width Erosion/Runoff-Floodplain quality (past 100 ft Riparian) Ban L R (per bank) Riparian width Erosion/Runoff-Floodplain quality (past 100 ft Riparian) Ban L R (per bank) Riparian width Riparian width Riparian your pasture (1) Riparian your pasture	Bank shapin
Left/Right banks looking downstream. (For each category, check only one per bank, OR two per bank and A Riparian width Eroslon/Runoff-Floodplain quality (past 100 ft Riparian) Ban L. R. (most predominant per bank) L. R. (most predominant per bank) Moderate 10-50m (3) Shrub or Old field (2) Moderate 10-50m (3) Residential, Park, New field (1) Wery narrow <5m (1) Fenced pasture (1) Wery narrow <5m (1) Fenced pasture (1) Minning, Construction (0) Mone (0) Comments: Depois maximum Pool/Gilde Quality (12 points maximum) Max pool depth (check one) Shrub or Old field (2) Morphology (check only one, pool/Run/Riffle current velocity (check only one, pool/Run/Riffle current vel	modifications
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L R (most predominant per bank) R (per bank)	A STATE OF THE PARTY OF THE PAR
Whide >50m (4) Forest, Swamp (3) Conservation Tillage (1) Moderate 10-50m (3) Shrub or Old field (2) Urban or Industrial (0) What or Industrial (0) Mining, Construction (0) Mining, Constructi	k Erosion
Moderate 10-50m (3)	The second secon
Nerrow 5-10m (2) Residential, Park, New field (1) Mining, Construction (0) Very narrow <5m (1) Fenced pasture (1) Open Pasture/Rowcrop (0) None (0) Comments:	None or little (3)
□ Very narrow <5m (1)	Moderate (2)
None (0) Comments:	_Heavy/Severe (1)
5a-Pool/Glide Quality (12 points maximum Max pool depth (check one) Norphology (check only one, OR check two and AVERAGE) Eddies (1) Torrection of the control of t	
Max pool depth (check one) Morphology (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR check two and AVERAGE) Pool/Run/Riffle current velocity (check only one, OR	ma - m
> fm (6) OR check two and AVERAGE Eddies (1) Torre 0.7-1m (4) Pool width > riffle width (2) Fast (1) Inters 0.4-0.7m (2) Pool width = riffle width (1) Moderate (1) Inters	lide Score: 2
□ 0.7-1m (4) □ Pool width > riffle width (2) □ Fast (1) □ Inters □ 0.4-0.7m (2) □ Pool width = riffle width (1) □ Moderate (1) □ Intern	
0.4-0.7m (2) Pool width = riffle width (1) Moderate (1) Intern	
	70000000000000000000000000000000000000
INSTANTANT IN THE PARTY WITH CHIEF WARTER TO THE VISION OF THE PARTY WARTER TO THE PAR	ol (0)
<0.2m (pool=0) Comments:	See Jose
	Dun Season 7
	Run Score: 9
Riffle/run depth (check one) Riffle/run substrate Riffle/run embeddedni Generally-10cm, Max>50cm (4) Stable-e.g. cobble, boulder (2) Extensive (-1)	Normal/Low (1)
[프로마이터 (14. 14. 14. 14. 14. 14. 14. 14. 14. 14.	None (2)
	No riffle (0)
Generally-Scm (riffle=0) Comments:	THE STATE OF THE S
	ent Score: 3
	(square miles)
Comments:	

urveyor Sample Date	County A	Sean Islasson 7 10 37 Islan SempleType [] Habites []	HEI Score: 32
		Complete	112100010.125
mpacts/Miscella	neous	4-	
Major Supported Im-	pacts (Check all that apply)	Miscellaneous QHEI Informa	flon
None	Suburban		s reach representative
Industrial	Channelization	W. Direct	of stream?
☐ WWTP	Riparlan Removal		ž _e
Agricultural Livestock	Flow Alteration	Canopy Cover (% Open): 36 % Pool: 50	
Silvicultura	Mining	General QHEI Notes:	
Construction	Landfills	-	
Urban Runoff Pollution Impact Comm	Natural		
Polition impact Commi	ontsi		
	24	Marria	-
	of 1	Pools	,
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Le mae		Strand Little org	Grest"
Le mae		Strong way	Grest"

Surveyor Sample Dat	e County	MA	icro SampleTyp	e TV Habita	6	HEI Score:
RW 6/29/200	15 Monroe		250	Complete	1%	QHEI Score:
1-Substrate (20	points max	dmum)			Sut	strate Score:
Check 1 Predomi	nant Pool & 1 Pre	dominent Riffle	Su	bstrate Quality (c	heck only 1, or ch	eck 2 and AVERA
Check all that are p	present	P=Pool, R=R	iffle		Substrate Ori	gln
Predominant	the second second	dominant F	resent	Limestone(1)	Hardpan(0)	Lacustrin
<u>P</u> <u>B</u>		· <u>R</u>	PR	Titis(1)	Sandstone(C	
☐ ☐ Bldrs/Slabs(10		Hardpan(4)		Wetlands(0)	TRIp(Rap(0)	Coal fine
Goulders(9)		Detritus(3)	00	Sitt Cover	96 15	Embeddedness +Extensive(-2)
Gravel(7)	FF 5] [_ Muck(2) Silt(2)	75	Silt moder	Part of the second	Moderate(-1)
☐ ☐ Sand(6)		Sludge(1)	hñ l	Silt normal	OVITATION OF THE RESERVE	Low/Normai(0)
Bedrock(5)	50 E	Artificial(0)	00	Six free(1)	N DA	None(1)
NOTE: ignore sludge o	riginating from p	SATURN CONTRACTOR OF THE PARTY	ubstrates prese	int(2)		
sources; score based of	on natural substr	rtes Comm	ents: 2.5	+2-4 = -	5	
2-Instream Cov	er (20 point	s maximum				n Cover Score
Type (check ALL that	77 (1 / V. O. C. V.)		_	2	mount (check only	
Undercut banks(1)		eep pools(2)	Oxbows(1)	^	A Desire of the Control of the Contr	y 1, or 2 and AVE sive >75% (11)
Overhanging veget		ootwads(1)	Aquatic mac	rophytes(1)	-	rate 25-75% (7)
[JShallows(In slow w			Eigs and wo		The second secon	e 5-25% (3)
☐Rootmate(1)	Comments:				Nearly	absent <5% (1)
3-Channel Morp	phology (20)	(check only or	ne per category	OR two and AV	ERAGEI C	hannel Score
	velopment	Channeltzation		Stability	Modifications/Ot	
High (4)	Excellent (7)	None (6)	-	High (3)	Snagging	Impour
	Good (5)	Recovered (a a	⊆Moderate (2)	Relocation	Hslands
	Fair (3)	Recovering	100	Low (1)	Canopy Remo	
	Poor (1)	Recent or no		шеетти	Dredging	Banks
	us anarat	Control of the contro	us whiter	No. Th		nnel modification
4-Riparian Zone			The second of the second of the second of		D	iparian Score
Left/Right banks to	THE PROPERTY AND ADDRESS.					
Riparian width	The same of the sa	the same of the sa	The state of the s	100 ft Riparian)	Cit two per Linia.	Bank Erosion
L R (per bank)	-	nost predominar		LR		L R (per ban
☑ Wide >50m (4)		rest, Swamp (3)		Conserva	tion Tillage (1)	☐ None or litt
		rub or Old field	(2)	Urban or	ndustrial (0)	Moderate (
☐ Moderate 10-50d	9 Re	sidential, Park, I	Control of the Contro		postruction (0)	Heavy/Sev
Moderate 10-50d		nced pasture (1)	9.1	COpen Pas	ture/Rowcrop (0)	
Narrow 5-10m (2						
Narrow 5-10m (2	Comments:	· 5 +1.5+0	+ 1			
Narrow 5-10m (2	Comments:				Poo	al/Glide Score
Narrow 5-10m (2	Comments: []	· 5 +1.5+0	num	1 S 1 5 12 S 14 S	Poo	
Narrow 5-10m (2 Very narrow <5n None (0) Sa-Pool/Glide Q	Comments: [] (uality (12 p ck one) Mo	oints maxir	TIUM k only one,	1 S 1 5 12 S 14 S	le current velocity	
Narrow 5-10m (2 Very narrow <5n None (0) Sa-Pool/Glide Q Max pool depth (chec	(uality (12 p	oints maxir	TIUM k only one, AVERAGE)	Pool/Run/Rif	le current velocity	
Narrow 5-10m (2 Very narrow <5n None (0) 5a-Pool/Glide Q Max pool depth (check 10	Comments: [] (uality (12 p	oints maxing phology (check two and Pool width = riff	HUM k only one, AVERAGE) e width (2) e width (1)	Pool/Run/Riff Eddies (1) Fast (1) Moderate	current velocity	y (check all that a forrential (-1) interstitial (-1) intermittent (-2)
Narrow 5-10m (2 Very narrow <5n Very narrow <5n None (0) Sa-Pool/Glide Q Max pool depth (check S-1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1)	(uality (12 p	oints maxing phology (check two and Pool width = riffl Pool width < ri	HUM k only one, AVERAGE) e width (2) e width (1)	Pool/Run/Riff Eddies (1)	current velocity	y (check all that a forrential (-1) nterstitial (-1)
Narrow 5-10m (2 Very narrow <5n Very narrow <5n None (0) Sa-Pool/Glide Q Max pool depth (chee S-1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <0.2m (pool=0)	Comments: [3] (uality (12 p) ck one) Mo OF Comments:	oints maxing phology (check two and Pool width = riffl Pool width < ri	HUM k only one, AVERAGE) e width (2) e width (1)	Pool/Run/Riff Eddies (1) Fast (1) Moderate	current velocity	y (check all that a forrential (-1) interstitial (-1) intermittent (-2)
Narrow 5-10m (2 Very narrow <5n Very narrow <5n None (0) Sa-Pool/Glide Q Max pool depth (check S-1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1)	Comments: [] (uality (12 p) ck one) Mo OF Comments:	oints maxing phology (check two and Pool width = riffl Pool width < ri	HUM k only one, AVERAGE) e width (2) e width (1) e width (0)	Pool/Run/Riff Eddies (1) Fast (1) Moderate		(check all that a forrential (-1) nterstitlal (-1) ntermittent (-2) to pool (0)
Narrow 5-10m (2 Very narrow <5n Very narrow <5n None (0) Sa-Pool/Glide Q Max pool depth (chee S-1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <0.2m (pool=0)	Comments: [] (uality (12 p ck one) Ma OF Comments: (uality (8) (c)	oints maxing phology (check two and Pool width = riffl Pool width < ri	NUM k only one, AVERAGE] e width (2) e width (1) e width (0)	Pool/Run/Rift Eddies (1) Fast (1) Moderate Slow (1)		(check all that a formential (-1) interstitial (-1) intermittent (-2) lo pool (0)
Narrow 5-10m (2 Very narrow <5n Very narrow <5n None (0) Sa-Pool/Glide Q Max pool depth (chee S-1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <0.2m (pool=0) Sb-Riffle/Run Q	Comments: [] (uality (12 p) ck one) Mo OF Comments: (uality (8) (c) k one)	pints maxin rephology (check the and Pool width = riffl Pool width < riffl heck only one po	NUM k only one, AVERAGE] e width (2) e width (1) e width (0)	Pool/Run/Riff Eddies (1) Fast (1) Moderate Slow (1) two and AVERA	(1) CIN	(check all that a formential (-1) interstitial (-1) intermittent (-2) lo pool (0) fle/Run Score: ledness
Narrow 5-10m (2 Very narrow <5n Very narrow <5n None (0)	Comments: [] (uality (12 p) ck one) Mo OF Comments: (uality (8) (c) k one) ax>50cm (4)	points maxing rephology (check theck two and Pool width = riff) Pool width < riff) Pool width < riff) heck only one pool Riffle/run sul	NUM k only one, AVERAGE) e width (2) e width (1) e width (0) er category, OR betrale	Pool/Run/Riff Eddies (1) Fast (1) Moderate Slow (1) two and AVERA	(1) CIF	(check all that a formential (-1) interstitial (-1) intermittent (-2) lo pool (0) fle/Run Score: ledness
Narrow 5-10m (2 Very narrow 5-10m (2 None (0) 5a-Pool/Glide Q Max pool depth (check S-1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <0.2m (pool=0) 5b-Riffle/Run Qt Riffle/run depth (check Generally>10cm, Milling Generally 5-10cm (1)	Comments: [] (uality (12 p) ck one) Mo OF Comments: (uality (8) (c) k one) acc>50cm (4) acc<50cm(3)	oints maxin rephology (check the and Pool width > riffl Pool width < riffl heck only one pe Riffle/run sut Stable-e.s	Num k only one, AVERAGE) e width (2) e width (1) e width (0) er category, OR batrate j, cobble, bould	Pool/Run/Rift Eddies (1) Fast (1) Moderate Slow (1) two and AVERA	(1)	(check all that a forrential (-1) interstitial (-1) intermittent (-2) lo pool (0) fie/Run Score:
Narrow 5-10m (2 Very narrow 5-10m (2 Very narrow 5-10m (2 None (0) Sa-Pool/Glide Q Max pool depth (check S-1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <0.2m (pool=0) Sb-Riffle/Run Qt Riffle/run depth (check Generally>10cm, Milling Generally>10c	Comments: [] (uality (12 p) ck one) Mo OF Comments: (uality (8) (c) k one) acc>50cm (4) acc<50cm(3)	oints maxing phology (check two and Pool width > riffl Pool width < riffl heck only one particles of Mod. stable—0.5	NUM k only one, AVERAGE e width (2) e width (1) e width (0) er category, OR betrale p, cobble, bould fie-e.g. pea gran	Pool/Run/Rift Eddies (1) Fast (1) Moderate Slow (1) two and AVERA	(1)	(check all that a forrential (-1) interstitial (-1) intermittent (-2) io pool (0) fie/Run Score: Normal/Lew None (2)
Narrow 5-10m (2 Very narrow 5-10m (2 None (0) 5a-Pool/Glide Q Max pool depth (check S-1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <0.2m (pool=0) 5b-Riffle/Run Qt Riffle/run depth (check Generally>10cm, Milling Generally 5-10cm (1)	Comments: [] (uality (12 p) ck one) Ma OF Comments: (uality (8) (c) k one) ax>50cm (4) ax<50cm(3) (1) (e=0) Comm	oints maxin rephology (check two and Pool width > riffl Pool width < riffl heck only one po Riffle/run su Stable-e.s Mod. stab	NUM k only one, AVERAGE e width (2) e width (1) e width (0) er category, OR betrale p, cobble, bould fie-e.g. pea gran	Pool/Run/Rift Eddies (1) Fast (1) Moderate Slow (1) two and AVERA	(1) In the contract of the c	(check all that a forrential (-1) interstitial (-1) intermittent (-2) to pool (0) fie/Run Score: Normal/Lew None (2)

rveyor Sample Date		facro SampleType T Habitat Complete	QHEI Score: [37.37]
npacts/Miscella	Morroe	Compress	
	Suburban Channelization Riparian Removal Flow Alteration CSOs Mining	Subjective rating (1-10): 4 % (1-10): 3 %	HEI Information Stiffe: 5 Is reach representative of stream?
Construction Urban Runoff	Landfills Natural	very homogeneous si	count a murphology
offstion Impact Commi			
qual qual	Govin -	Call Application of a	in factor
120 14		\$ 138 mm	Krust -
		201	

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Sample #	bloSample #	Stream Name		Location	
		- Johan Creek	THE RESERVE OF THE PARTY OF THE	3R 87	pridge
Surveyor Samp		Aorgan Mach	p SampleType	Habitat Complete	QHEI Score:
1-Substrate		ts maximum)			Substrate Score: 7
Check 1 Pre	dominant Po	ol & 1 Predominant Riffle	Substrate	Quality (check only	y 1, or check 2 and AVERAGE)
Check all tha	t are present	P*Pool, R*Riffle			strate Origin
Predominant	Presen	t Predominant Pres			rdpan(0) Lacustrine(0)
<u>P</u> <u>R</u>	P B	444 (444)	R //Tills(ndstone(0) Shale(-1)
□ □ Bldrs/Sl:	1000000 - 5,00000000000000000000000000000	☐☐Mardpan(4) ☐	STATE STORY		(Rap(0) Coal fines(-2)
☐ ☐ Boulders		Detritus(3)		Cover lit heavy(-2)	Embeddedness Extensive(-2)
Gravel(7	T	Desires	TARREST TO THE PROPERTY OF THE PARTY OF THE	Ilt moderate(-1)	Moderate(-1)
☐ ☐Sand(6)	EE	Sludge(1)	A CONTRACTOR OF THE PARTY OF TH	ilt normal(0)	(Low/Normal(0)
Bedrock	(5)	Artificiak(0)]	Of free(1)	Nane(1)
OTE: Ignore slu			strates present(2)		700
ources; score b	ased on natur	al substrates Comment	is; 1/ // - /	4 = 1	
2-Instream	Cover (20	points maximum		- 1	nstream Cover Score: 12
Type (check AL	L that apply)	Caralla Maria Valla		Amount (c	heck only 1, or 2 and AVERAGE
,Undercut bac	ks(1)	Deep pools(2)	Oxbows(1)		☐ Extensive >75% (11)
Overhanging			Aquatic macrophyte		Moderate 25-75% (7)
_]Shallows(in s		The second secon	Logs and woody de	bris(1)	Sparse 5-25% (3)
Rootmats(1)	14-15-16-16	nents: [X/DRY			Meanly absent <5% (1)
3-Channel M	dorpholo	gy (20) (check only one)	per category, OR tw	o and AVERAGE)	Channel Score: 7
Sinuosity	Developmi	ent Channelization	Stabilit	y Modifie	ations/Other
High (4)	Excelle	nt (7) None (6)	□Hlgh		gging Impound
Moderate (3)	Good (6		The second secon		cationlslands
Low (2)	Fair (3)	Necovering (3)	Low		opy Removal Leveed
None (1)	UPoor (1				Iging Bank shapin side channel modifications
	solitus		Maria Company of the	17.00	
The state of the s	270-2 April 610-1171	ink Erosion (10 poi		The same of the same of the same of	Riparlan Score: 3
All the second control of the second control	iks looking de	whatream (For each catego	Control of the second of the s	And the second s	
Riparian width L R (per bank		Erosloru/Runoff-Floodplain	A STATE OF THE PARTY OF THE PAR	Ripanan)	Bank Erosion L R (per bank)
☐ ☐ Wide >50n	707	L R (most predominant p		Conservation Tilla	The second secon
Moderate		Shrub or Old field (2)	Laterial Laterial	Urban or Industria	
Namow 5-1		Residential, Park, Nev		Mining, Constructi	요즘 아름답니다. 그리 경영에 급급하게 하고 있는데 되었다. [2] [2] [2] [2] [2] [2] [2] [2] [2] [2]
Very narro	w <5m (1)	Fenced pasture (1)	P. V	Open Pasture/Row	crop (a)
None [0]	Comme	nts:			
a-Pool/Glic	de Quality	(12 points maximu	ım		Pool/Glide Score:
Max pool depth		Morphology (check o	The second second	ol/Run/Riffle curren	it velocity (check all that apply)
[]>1m (6)		OR check two and AV	PERSONAL PROPERTY.	Eddies (1)	Torrential (-1)
0.7-1m (4)		Pool width > riffle w		Fast (1)	☐ Interstitial (-1)
0.4-0.7m (2	7.5	Pool width = riffle w		Moderate (1)	☐-Intermittent (-2)
☐ 0.2-0.4m (1		Poul width < riffle w	ridth (0)	Slow (1)	No pool (0)
<0.2m (poc		omments:			
b-Riffle/Ru	n Quality	(8) (check only one per o	alegory, OR two an	d AVERAGE)	Riffle/Run Score:
Riffialron dands	(check one)	Riffle/run subst	rate	Riffle/rui	n embeddedness
			(2) rebluod , siddo	Exter	sive (-1) Normal/Low (1)
Generally>10c	em, Max <50em		e.g. pea gravel (1)	Mode	rate (0) None (2)
Generally>10c		to off the schools be as as	L sand, gravel (0)		Mo riffle (0)
Generally>10c Generally>10c Generally 5-10	Dam (1)				
Generally>10c Generally>10c Generally>10c Generally 5-10c Generally<5cr	Dam (1) m (riMe=0)	Comments:			
Generally>10c Generally>10c Generally>10c Generally 5-10 Generally<5cr	Dam (1) m (riMe=0)			10 11	Gradient Score: 0-
Generally>10c Generally>10c Generally 5-10c Generally<5cr	oom (1) n (rime=0) 10 points	Comments:	(titimile)	Drainage Area	

mple#	bioSan	nple #	Stream Name	Location	
			690AN	(veek	ESR37 bridge
rveyer	Sample Date	County		tacro SampleType [1] Habitat Complete	QHEI Score: 25
	10130 10		000 N	Complete	and the second
pact	s/Miscella	aneous			
Major	Suspected Im	pacts (Chec	k all that apply)	1 Miscellancous (QHEI Information
A STATE OF THE	None		rrban	THE ACTION OF THE PARTY OF THE	Riffie: Is reach representative
	Industrial		netization		Run: of stream?
	WWTP		rian Removal		Glide: - E, d
	Agricultural	100000000000000000000000000000000000000	Alteration		Pool:
	Livestock Streigulture	GSO		General QHEI Notes:	
	Construction	Line	- 70	appears mes	like a ditch
	Urban Runoff	Natu			
Stution	Impact Comm	ents:			
7.7.1					
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		NET	155	1	
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89.37	2		7 1		
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ラゴバー 新聞版 A	Q Biological Studies Q	IEI (Qualitative Habitat Ev	aluation index) (2.1%)
Sample # bloSample #	Stream Name	Location	- The section of
Surveyor Sample Date Count	the state of the s		ridge
The state of the s	y Macro Samp	VeType Habitat Complete	QHEI Score: 34
	maximum)	THE MAN DE CANADA	Substrate Score: []
Check 1 Predominant Pool		Substrate Quality (check only 1, o	The Control Statement (COS)
Check all that are present	P=Pool, R=Riffle	Substrate	
Predominant Present	Predominant Present	Limestone(1) Hardpan	THE PROPERTY OF THE PARTY OF TH
PRPR	PR PR	[] Tills(1) [] Sandsto	551 (55. P) (1) (2) (4) (2) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4
Bldrs/Slabs(10)	☐☐Hardpen(4)☐☐☐	_:Wetlands(0)	
Boulders(9)	D Detritus(3) [2]	Silt Cover	Embeddedness
Cobble(8)	□□Muck(2) □□ ☑□Sin(2) □□	Silt heavy(-2)	LExtensive(-2) Moderate(-1)
[] [Sand(8) []	Sludge(1)	Silt normal(0)	Low/Normal(0)
☐ ☐Bedrock(5) ☐ ☐	□□Artificiak(0) □□	☐Silt free(1)	None(1)
NOTE: ignore sludge originating t		present(2)	CONTRACTOR OF THE
sources; score based on natural s	substrates Comments: 4	1+2=6 (-5) 1	
2-Instream Cover (20 p	oints maximum	Instr	eam Cover Score:
Type (check ALL that apply)	LEW LUNGGET TELES		only 1, or 2 and AVERAGE
Undercut banks(1)	Deep pools(2) Cxbown		densive >75% (11)
Overhanging vegetation(1)		HING SANGER	oderate 25-75% (7)
Shallows(in slow water)(1)			iarse 5-25% (3)
Rootmats(1) Commer	1410	Line	sarty absent <5% (1)
3-Channel Morphology	(20) (check only one per cate	gory, OR two and AVERAGE)	Channel Score: 5
Sinuosity Development	**************************************	Stability Modification	The state of the s
High (4) Excellent		High (3) Snagging	Control of the Contro
Moderate (3) Good (5)	Recovered (4)	Relocatio	
None (1)	Recovering (3)	Low (1) Canopy F (1) Dredging	
Comments:	L'S Rocelle de no recovery		channel modifications
4-Rinarian Zone & Ran	k Erosion (10 points m	navimum)	Dinasian Conen
			Riparian Score:
	rosion/Runoff-Floodplain quality	ck only one per bank, OR two per ba	Bank Erosion
L R (perbank) L	R (most predominant per bank		L R (per bank)
The state of the s	Forest, Swamp (3)	Conservation Tillage (1)	Anti- Date Barrier Committee Committ
Moderate 10-50m (3)	Shrub or Old field (2)	Urban or Industrial (0)	☐ ☐ Moderate (2)
, Narrow 5-10m (2)	Residential, Park, New field	**************************************	
☐ Very narrow <5m (1) ☐	Fancad pasture (1)	12 10pen Pasture/Rowerop	(0)
None (0) Comments	The state of the s		
5a-Pool/Glide Quality (12 points maximum		Pool/Glide Score: 🖺
Max pool depth (check one)	Morphology (check only one OR check two and AVERAGE	The second secon	AND DESCRIPTION OF THE PROPERTY OF THE PROPERT
[≥>1m (6) □ 0.7-1m (4)			Torrential (-1)
0.4-0.7m (2)	Pool width > riffle width (2)		☐ Interstitial (-1) ☐ Intermittent (-2)
0.2-0.4m (1)	Pool width < riffle width (0)		□No pool (0)
	ments:	Same 30.5 - 20.4	
5b-Riffle/Run Quality (8	(check only one per category	V. OR two and AVERAGE	Riffle/Run Score:
Riffle/run depth (check one)	Riffle/run substrate	Riffle/run amit	
Generally>10cm, Max>50cm (4	and the same of th		
Generally>10cm, Max<50cm[3			
Generally 5-10cm (1)	☑ Unstable-e.g. sand,		No riffle (0)
Generally<5cm (riffle=0)	Comments:		
6-Gradient (10 points n	naximum)		Gradient Score: 6
Average width: 4m	Gradient: (b) (ftir	nile) Drainage Area:	(square miles)
Comments:			
		OWQ Biological Stud	les OHEL *
		CALCO DICTORISM 2000	reserved to the total

nale # bloSem	the state of the s	Location	
reyor Sample Date	County &		C SR 37
Sample Date	County	facro SampleType 5/3 Habitat Complete	QHEI Score: 34
pacts/Miscella	neous	1 2	
Major Suspected Imp	eacts (Check all that apply)	1 Miscellaneous Cir	El Information
None Industrial WWTP Agricultural Livestock	Suburban Channelization Flow Alteration CSOs	Subjective rating (1-10): 5 % Rti Aesthetic rating (1-10): 3 % Rti Canopy Cover (% Open): 30 % Pt General QHE Notes:	un: 80 ofstroam? Ues
Styleuiture Construction	☐Mining ☐Landfills	Substitute very loose, si	dey
Urban Runoff	Natural		
llution Impact Comme	onts:		1 25
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			Bran Blossom (

Sumple # Surveyor Sample 6/89 1-Substrate	bloSample #	Stream Name	-	Locat	adiu	
16/89	CONTRACTOR OF THE PARTY OF THE		Creek		9. 52-37 1	ordae.
	reference of the Additional Section 1	+ Ma	scro Sample Ty		Market Company of the	El Score: 64
					Subst	rate Score: [17
Check 1 Pre	dominant Pool &	f Predominant Riffle	[57	ubstrale Quality (ch		The state of the s
Check all that	THE RESERVE OF THE PARTY OF THE	P*Pool, R=R	992/201		Substrate Origin	
Predominant	Present	Predominant P	Present	Limestone(1)	Hardpan(0)	[Lacustrine(0)
PR	E B	P-B	PB	Tala(1)	Sandstone(0)	☐ 5/hale(-1)
□ □ Bldrn/Sla	The second secon	Hardpon(4)	BB	Wetlands(0)	Rip/Kap(0)	Cnal fines(-2)
Boulders	The second secon	Det/itus(3)	PP	Silt Cover		nbeddedness
Cobble(8)	चित्र	☐ ☐ Muck(2) ☐ ☐ Sil(2)	HH	Silt heavy(-2	Marian Committee	ctensive(-2) oderate(-1)
□ □ Sand(6)	10.70	Sludge(1)	DO	Sill normal(0	17.0°	ow/Normal(0)
□ □ Bedrock(5) DU	☐ Artificial(0)	OG	Silt free(1)	The second secon	one(1)
OTE: Ignore sluc			ubstrates pres	ent(2)		
cources; score ba	sed en natural s	distrates Comm	ents:			
2-Instream (Cover (20 pe	oints maximum	9		Instream C	over Score:
Type (check ALL	Went enter 15 Co.		-	Am		or 2 and AVERAGE)
Underput bank		GOeep pools(2)	Oxbows(1)			e >75% (11)
Soverhanging	regetation(1)	CRootwads(1)	Aquatic ma	crophytes(1)	(Efficients)	25-75% (7)
-Shallowelin si	ow water(1)	Boulders(1)	LEDGE and w	cody debris(1)	☐5parse 5	
iRootmats(1)	Comment	*: 10-			Nearly at	sent <5% (1)
3-Channel M	orphology	(20) (check only oc	ne per category	y, OR two and AVE	RAGE) Ch	nnel Score: 3.3
Sinuosity	Development	Channelization		Stability	Modifications/Othe	to the same of the
High (4)	Excellent (7) (Vitione (fi)		☐ High (3)	Snagging	[]impound
Moderate (3)	Good (5)	Recovered (12.50	Moderate (2)	Relocation	Italiands
Low (2)	Pfair (3)	Recovering	70.75	@Low (1) 115	Ganopy Remova	
None (1)	Poor (1)		recovery (1)	270	Dredging One side channe	Bunk shaping
-	am too e	CONTRACTOR OF STREET	A CHARLE STREET			
	777 J. S.	Erosion (10 p		The state of the s		arian Score: 1/.5
	A STATE OF THE PERSON NAMED IN	stream (For each cate	THE RESIDENCE OF THE PERSON NAMED IN	A STATE OF THE PARTY NAMED IN COLUMN TWO IS NOT	A STATE OF THE PERSON NAMED IN	COLOR DESIGNATION OF THE PERSON OF THE PERSO
Riparian width	Er	oslon/Runoff-Floodpla	The second secon		B	ank Erosion
L R (per bank) ☐ Wide >50m	(B)	R (most predominar Forest, flwamp (3)		L R □ □ Conservation	m Tillaum (1)	B (per bank) None or little (3)
Moderate 1		Strub or Old field		Urban or in		Moderate (2)
Warrow 5-1		Residential, Park, 1	Production of the law		retruction (0)	The second second second second second
☐ Very narrow	v <5m (1)	Fenced pasture (1)	TOTAL PROPERTY.	COpen Paste		
None (0)	Comments					
a-Pool/Glid	e Quality (1	2 points maxir	num		Pools	Slide Score: [9]
Max pool depth	(check pris)	Morphology (chec	k only one.	Poststun/Rittle		heck all that apply)
(6)		DR check two and		Eddies (1)		ential (-1)
0.7-1m (4)		Pool width > riffl	is width (2)	[]Fast (1)	Effite	rstitial (-1)
0.4-0.7m (2)		Pool width = riffi	le width (1)	Moderate (1] Inte	rmittent (-2)
0.2-0.4m (1)		Pool width < attl	e width (0)	☐5low(1)	No	pool (0)
[]<0.2m (poo	710					
b-Riffle/Ru	Quality (8	[check only one pe	er category, OF	R two and AVERAG	E) Riffle	/Run Score: 2
Riffin/run depth (check one)	Riftle/run sul	hstrate	R	iffle/run embedded	ness
	m, Max>50cm (4)		g. cobble, bout		Extensive (-1)	-Normal/Low (1)
	m, Max <50cm(3)	September Carden - Total Control	olo-e.g. pea gra		Moderate (3)	None (2)
Generally 5-10 Generally-Scn	THE PARTY OF THE P		e.g. sand, grav	/et {0}		He riffic (0)
	Mon Voyer	omments:				
-Gradient (o points m				Color Color Color	dient Score: (2
	1 2	Gradient: 10	(ft/mile)	Ciralnag	on Area:	(square miles)
Average widts	-	The second secon				

mple # bloSample #	Stream Name	24000	Location	027	
veyor Sample Date Count	BY/ANT	facro SampleType []	Habitat	QHEI So	noro:
	RSAN I	Co	emplete	GITE S	1016.164
npacts/Miscellaneou	15		976	-	1
Major Suspected Impacts (C	thick all that apply)	1 Min	cellimeous QHE	Information	
The second of th	Suburban	Subjective rating (1-1)			spresontative
The state of the s	Thannelization	Assiliatic rating (1-1)	O) K NO		2 yer
	Sparian Removal Flow Alteration	Canopy Cover (% Oper	Luthur % Otto	ot 20	U
Lirestock C	75Os	General QHEI Notes:	175	100.1	
	Ainteg andfills		0 .11		
- Early College School and Land College School and	iatural				
ollution impact Comments:		4.0			
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56 c - 50.37	→ MB		aux A	RON	
56 c 54.37	→ MB		and the same of th	Row	

Surveyor Sample Date County	The second second		
The state of the s	Macro Sampl	eType Habitat Complete	QHEI Score: 58
1-Substrate (20 points m	naximum)	33.03.00	Substrate Score: 17
Check 1 Predominant Pool & 1		Substrate Quality (check only 1	THE COURSE PROPERTY OF THE PARTY OF THE PART
Check all that are present	P#Pool, R=futfie		te Origin
Predominant Present	Predominant Present	Limestone(1) Hardp	District Control of the Control of t
PR PR	PR PR		tone(0) Shale(-1)
□□Ridrs/Slabs(10) □□□	☐ ☐ Hardpan(4) ☐ ☐	☐Wetlands(0) ☐Rip/R	
☐ [Houlders(9)] []	Detritus(3)	Silt Cover	Embeddedness
Cobble(8)	□□Muck(2) □□	Silt heavy(-2)	Extensive(-2)
Gravel(7) Let's	☑ □SIN(2) □ □	Sất moderate(-1)	[_:Moderate(-1)
☑ (Sand(6)	Sludgo(1)	Silt normal(0)	Low/Normal(0)
□□Bedrock(5) □□□	☐ ☐ Artificial(0) ☐ ☐	Sat free(1)	None(1)
NOTE: ignore studge originating fro			
sources; score based on natural sub	ostrates Comments: 10	5+2=12.5-113,5-20	11.5
2-Instream Cover (20 po	ints maximum	Ins	tream Cover Score:
Type (check ALL that apply)			ck only 1, or 2 and AYERAG
, Undercut banks(1)	Deep pools(2) Oxbows	The state of the s	Extensive >75% (11)
Overhanging vegetation(1)		macrophytes(1)	Moderate 25-75% (T)
(Shallows(in slow water)(1)	Boulders(1) Tebgs an		Брагъе 5-25% (3)
Reotmats(1) Comments		10	Nearty absent <5% (1)
3-Channel Morphology (20) (check only one per cate	gery, OR two and AVERAGE)	Channel Score: 7
Sinuasity Development	Channelization	Stability Modification	The state of the s
High (4) Excellent (7)	- constitution and the contract of the contrac	[]High (3) []Snaggi	Access of the second se
[Moderate (3) Good (5)	Recovered (4)	(Moderate (2) Reloca	12.50
Cow (2) OFair (3)	Recovering (3)		Removal Leveed
□None (1) □Poor (1)	Recent or no recovery		
Comments:		☐ One sid	fe channel modifications
	Erosion (10 points m	NAME OF TAXABLE PARTY OF TAXABLE PARTY.	Control of the Contro
4-Riparian Zone & Bank		aximum)	Riparian Score:
4-Riparian Zone & Bank LeftRight banks looking downs	tream (For each category, chec	naximum) ok only one per bank, OR two per	Riparian Score: bank and AVERAGE).
4-Riparian Zone & Bank LeftRight banks looking downs Riparian width Ero	tream (For each category, chec slowRunoff-Floodplain quality	naximum) cà only one per bank, OR two per (past 100 ft Riparian)	Riparian Score: hank and AYERASEL Bank Erosion
4-Riparian Zone & Bank LeftRight banks looking downs Riparian width Ero L R (per bank) L R	tream (For each category, chec sion/Runoff-Floodplain quality R (most predominant per bank	naximum) ck only one per bank, OR two per (past 100 ft Riparlan) 1 L R	Riparian Score: : : bank and AVERAGE). Bank Erosion L. R. (per bank)
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ero L R (per bank) L R Wide > 50m (4)	tream (For each category, chec sion/Runoff-Floodplain quality R (most predominant per bank Forest, Swamp (3)	naximum) ck only one per bank, OR two per (past 100 it Riparian) L R Conservation Tillage	Riparian Score: : bank and AVERAGE]. Bank Erosion L R (per bank) (1) None or little (3)
4-Riparian Zone & Bank LeftRight banks looking downs Riparian width L B (per bank) L B (width > 50m (4) Moderate 10-50m (3)	tream (For each category, chec sion/Runoff-Floodplain quality R (most predominant per bank Forest, Swamp (3) Bhrub or Old field (2)	haximum) ch only one per bank, OR two per (past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0	Riparian Score: : bank and AVERAGE]. Bank Erosion L. R. (per bank) (1) None or little (3)
4-Riparian Zone & Bank LeftRight banks looking downs Riparian width Ero L B (per bank) L I	tream (For each category, chec sion/Runoff-Floodplain quality R (most predominant per bank Forest, Swamp (3)	haximum) ch only one per bank, OR two per (past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0	Riparian Score: : bank and AVERAGE] Bank Erosion L R (per bank) (1) None or little (3) Stoderate (2) (0) Heavy/Severe (
4-Riparian Zone & Bank LeftRight banks tooking downs Riparian width Ero L R (per bank) L f Wide >50m (4) L f Moderate 10-50m (5) Marrow 5-10m (2)	tream (For each category, chec slor/Runoff-Floodplain quality R (most predominant per trank Forest, Swamp (3) Bfirub or Old field (2) Residential, Park, New field (1)	haximum) ch only one per bank, OR two per (past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0	Riparian Score:
4-Riparian Zone & Bank LeftRight banks looking downs Riparian width Ero L R (per bank) L f Wide > 50m (4) L f Moderate 16-50m (3) Marrow 5-10m (2) L f None (0) Comments:	tream (For each category, checklon/Runoff-Floodplain quality it (most predominant per bankle Forest, Swamp (3) British or Old field (2) Residential, Park, New field (1) Fenced posture (1)	haximum) ch only one per bank, OR two per (past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0	Riparian Score:
4-Riparian Zone & Bank LeftRight banks tooking downs Riparian width Ero L R (per bank) L t Wide >50m (4) L t Moderate 10-50m (3) W Narrow 5-10m (2) L t None (0) Comments: 5a-Pool/Glide Quality (12	tream (For each category, checklon/Runoff-Floodplain quality) R (most predominant per bankle Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced posture (1) 2 points maximum	haximum) ch only one per bank, OR two per (past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0) Mining, Construction Copen Pasture/Rowco	Riparian Score: tank and AVERAGE] Bank Erosion L R (per bank) (1) None or little (3) (0) Moderate (2) (0) Heavy/Severe (1) (0) Pool/Glide Score: 1
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ero L R (per bank) L F Wide > 50m (4) L F Moderate 16-50m (3) Marrow 5-10m (2) L F Very narrow < 6m (1) L F None (0) Comments:	tream (For each category, checklon/Runoff-Floodplain quality it (most predominant per bankle Forest, Swamp (3) British or Old field (2) Residential, Park, New field (1) Fenced posture (1)	haximum) ch only one per bank, OR two per (past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0 Mining, Construction Copen Pasture/Rowco	Riparian Score: tank and AVERAGE Bank Erosion L R (per bank) (1) None or little (3) (0) Moderate (2) (0) Heavy/Severe (op (0)
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ero L R (per bank) L (Wide > 50m (4) L (Moderate 16-50m (3) L (Narrow 5-10m (2) L (None (0) Comments: 5a-Pool/Glide Quality (12) Max pool depth (check one)	tream (For each category, checklon/Runoff-Floodplain quality) R (most predominant per bankle Forest, Swamp (3) Bhrub or Old field (2) Residential, Park, New field (*) Fenced posture (1) 2 points maximum Morphology (checklonly one	Aximum Construction	Riparian Score: : bank and AVERAGE]. Bank Erosion L R (per bank) (1) None or little (3) (0) Heavy/Severe (op (0)) Pool/Glide Score:
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ero L R (per bank) L f Wide > 50m (4) L f Moderate 16-50m (3) Marrow 5-10m (2) L f None (0) Comments: 5a-Pool/Glide Quality (12) Max pool depth (check one) > 1m (6)	tream (For each category, checklon/Runoff-Floodplain quality it (most predominant per bankle Forest, Swamp (3) British or Old field (2) Residential, Park, New field (1) Fenced posture (1) 2 points maximum Morphology (check only one OR check two and AVERAGE	Aximum Construction	Riparian Score: hank and AVERAGE]. Bank Erosion L R (per bank) (1) None or little (3) (0) Heavy/Severe (1) (0) Heavy/Severe (1) (0) Pool/Glide Score: Pool/Glide Score:
4-Riparian Zone & Bank LeftRight banks looking downs Riparian width Ero L R (per bank) L ! Wide > 50m (4) L ! Mederate 16-50m (3) Marrow 5-10m (2) L ! None (0) Comments: 5a-Pool/Glide Quality (12) Max pool depth (check one) > 1m (6) - 0.7-1m (4)	tream (For each category, check ston/Runoff-Floodplain quality it (most predominant per bank Forest, Swamp (3) British or Old field (2) Residential, Park, New field (1) Fenced posture (1) 2 points maximum Morphology (check only one OR check two and AVERAGE Fool width > riffle width (2)	Aximum) a only one per bank, OR two per [past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0 Mining, Construction Copen Pasture/Rowco Pool/Run/Riffle current v Feddies (1) Fast (1) Moderate (1)	Riparian Score: hank and AVERAGE]. Bank Erosion L. R. (per bank) (1) None or little (3) (0) Heavy/Severe (1) (0) Heavy/Severe (1) (0) Pool/Glide Score: Selectly (check all that apply Torrential (-1) Interstitial (-1)
4-Riparian Zone & Bank LeftRight banks looking downs Riparian width Ero L R (per bank) L ! Wide >50m (4) Moderate 16-50m (3) Narrow 5-10m (2) None (0) Comments: 5a-Pool/Glide Quality (1) Max pool depth (check one) >1m (6) © 0.7-1m (4) © 6.4-9.7m (2)	tream (For each category, checklon/Runoff-Floodplain quality) R (most predominant per bankle Forest, Swamp (3) British or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one OR check two and AVERAGE Pool width > riffle width (2) Pool width < riffle width (3)	Aximum) a only one per bank, OR two per [past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0 Mining, Construction Copen Pasture/Rowco Pool/Run/Riffle current v Feddies (1) Fast (1) Moderate (1)	Riparian Score: hank and AVERAGE] Bank Erosion L R (per bank) (1) None or little (3) (0) Heavy/Severe (1) (0) Heavy/Severe (1) (1) Pool/Glide Score: Pop (3) Pool/Glide Score: Interestitial (-1) Interestitial (-1) Interestitial (-2)
4-Riparian Zone & Bank LeftRight banks tooking downs Riparian width Ero L R (per bank) L ? Wide >50m (4) L ? Wide >50m (4) L ? Narrow 5-10m (2) L ? None (0) Comments: 5a-Pool/Glide Quality (12 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) 0-0.2m (pool=0) Comme	tream (For each category, checklon/Runoff-Floodplain quality) R (most predominant per bankle Forest, Swamp (3) British or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one OR check two and AVERAGE Pool width > riffle width (2) Pool width < riffle width (3)	Aximum) a only one per bank, OR two per [past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0 Mining, Construction Copen Pasture/Rowco Pool/Run/Riffle current v Fast (1) Fast (1) Slow (1)	Riparian Score: hank and AVERAGE. Bank Erosion L. R. (per bank) (1) None or little (3) (0) Heavy/Severe (1) (0) Heavy/Severe (1) (0) Pool/Glide Score: Selectly (check all that apply Torrential (-1) (otherwitted (-1) Intermittent (-2) (No pool (0)
4-Riparian Zone & Bank LeftRight banks tooking downs Riparian width Ero L R (per bank) L ! Wide >50m (4) L ! Moderate 10-50m (3) Marrow 5-10m (2)	tream (For each category, check sion/Runoff-Floodplain quality it (most predominant per bank Forest, Swamp (3) Bhrub or Old field (2) Residential, Park, New field (1) Fenced posture (1) 2 points maximum Morphology (check only one OR check two and AVERAGE Pool width > riffle width (2) Pool width < riffle width (3) ents:	Aximum) A only one per bank, OR two per [past 100 it Riparian] B Conservation Tillage Urban or Industrial (0 in Mining, Construction (x) Copen Pasture/Rowco Pool/Run/Ruffle current (x) Eddies (1) Fast (1) Moderate (1) Slow (1)	Riparian Score: : bank and AVERAGE] Bank Erosion L R (per bank) (1) None or little (3) (0) Hoavy/Sovere (1) (0) Hoavy/Sovere (1) (0) Torrential (-1) Intermittent (-2) No pool (9) Riffle/Run Score: 4
4-Riparian Zone & Bank LeftRight banks tooking downs Riparian width Ero L R (per bank) L ! Wide >50m (4) L ! Moderate 10-50m (3) Marrow 5-10m (2) II None (0) Comments: 5a-Pool/Glide Quality (12 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) Sb-Riffle/Run Quality (8)	tream (For each category, check sion/Runoff-Floodplain quality it (most predominant per bank Forest, Swamp (3) Bhrub or Old field (2) Residential, Park, New field (1) Fenced posture (1) 2 points maximum Morphology (check only one OR check two and AVERAGE Pool width > riffle width (2) Pool width < riffle width (3) pool width < riffle width (6) ents:	A conty one per bank, OR two per (past 100 it Riparian) R	Riparian Score:
Left/Right banks looking downs Riparian width Ero L R (per bank) L f Wide >50m (4) L f Moderate 16-50m (3) C f None (0) Comments: 5a-Pool/Gilde Quality (12) Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) 5b-Riffle/Run Quality (8) Riffle/nun depth (check one) Generally>10cm, Max>50cm (4)	tream (For each category, check ston/Runoff-Floodplate quality is (most predominant per bank). Forest, Swamp (3). Shrub or Old field (2). Residential, Park, New field (1). Fenced posture (1). 2 points maximum. Morphology (check only one OR check two and AVERAGE. Pool width > riffle width (2). Pool width < riffle width (3). Pool width < riffle width (3). It is not stone on the category is not stone. Stable-e.g. cobble, it	A conty one per bank, OR two per (past 100 it Riparian) L R Conservation Tillage Urban or Industrial (0 Mining, Construction (0 Copen Pasture/Rowco) Pool/Run/Riffle current (1 Fast (1) Fast (1) Fast (1) Slow (1) OR two and AVERAGE) Rifflefrun e (2)	Riparian Score:
4-Riparian Zone & Bank LeftRight banks tooking downs Riparian width Ero L R (per bank) L ! Wide >50m (4) L ! Moderate 10-50m (3) Marrow 5-10m (2) II None (0) Comments: 5a-Pool/Glide Quality (12 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) Sb-Riffle/Run Quality (8)	tream (For each category, check sion/Runoff-Floodplain quality it (most predominant per bank Forest, Swamp (3) Bhrub or Old field (2) Residential, Park, New field (1) Fenced posture (1) 2 points maximum Morphology (check only one OR check two and AVERAGE Pool width > riffle width (2) Pool width < riffle width (3) pool width < riffle width (6) ents:	A conly one per bank, OR two per (past 100 it Riparian) L R	Riparian Score:
4-Riparian Zone & Bank LeftRight banks looking downs Riparian width Ero L R (per bank) L ! Wide > 50m (4) L ! Wide > 50m (4) L ! Norw (5-10m (2) L ! Norw (6) Comments: 5a-Pool/Glide Quality (1) Max pool depth (check one) > 1m (6) © 0.7-1m (4) © 0.2-0.4m (1) = 40.2m (pool=0) Comments Sb-Riffle/Run Quality (8) Riffle/nun depth (check one) Generally>10cm, Max>50cm (4) Generally>10cm, Max>50cm (4) Generally>10cm, Max>50cm (4)	tream (For each category, check ston/Runoff-Floodplate quality it (most predominant per bank) Forest, Swamp (3) British or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one. OR check two and AVERAGE Pool width > riffle width (2) Pool width < riffle width (3) Pool width < riffle width (6) ents: [check only one per category Riffle/run substrate Stable-e.g. cobble, the Mod. stable-e.g. pea	A conly one per bank, OR two per (past 100 it Riparian) L R	Riparian Score:
4-Riparian Zone & Bank LeftRight banks tooking downs Riparian width Ero L R (per bank) L ! Wide > 50m (4) L ! Wide > 50m (4) L ! None (0) Comments: 5a-Pool/Glide Quality (12 Max pool depth (check one) > 1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) - 40.2m (pool=0) Comme Sb-Riffle/Run Quality (8) Riffle/run depth (check one) Generally>10cm, Max>50cm (4) Generally>10cm, Max>50cm (4) Generally>10cm, Max>50cm (4)	tream (For each category, check stor/Runoff-Floodplain quality is (most predominant per bank Forest, Swamp (3) British or Old field (2) Residential, Park, New field (1) Fenced posture (1) 2 points maximum Morphology (check only one OR check two and AVERAGE Pool width > riffle width (2) Pool width < riffle width (3) ents: [check only one per category Riffle/run substrate Stable-e.g. cobble, the Mod. stable-e.g. pea Unstable-e.g. sand, semments:	A conly one per bank, OR two per (past 100 it Riparian) L R	Riparian Score:

nple# bloSam	ple# Stream Hame /	ittle Tadian Creek Location	Q SQ37
veyor Sample Date	County	Macro SampleType [] Habitat	QHEI Score: 58.0
14/30/2005	MORGAN 1	Complete	other ocore: 287
pacts/Miscella	neous		
Major Suspected Imp	pacts (Check all that apply)	Miscellaneous C	HEI Information
None	Suburban	A STATE OF THE PARTY OF THE PAR	tifflet: 30 Is reach representative
Industrial	Channelization		Run: 5 of stream? Uply
□ WWCP	Riperian Removal	Aesthetic rating (1-10): 5 % G	ilide: /5 =
Agricultural	Flow Alteration	Canopy Cover (% Open): 30 %	Pool:(30)
Livestock Sitviculture	☐CSOs ☐Mining	General QHEI Notes:	
Construction	Landfills	small trush @ box	- Smal
Urban Runoff	□Natural	SMANI Trush @ bn	17c
Mution Impact Commi	ents:		
	48		
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1	54	(C)	
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		Point in point	Ag
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		Point in point	Ag
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AND A STORE A		TARKALI	DIVIUUIGARD	LULISTO EXITE	I (Qualitative)	labitat Evalt	Jauoningeri	
Sample #	bloSamp		Stream Name	ER 231136 ET 10 (6 142 f)		ation		remenal.
(253e)	· Siosamp						Creek	/
·	mple Date	County	kamana <u>umananin</u> .	Macro Samplel		7	QHEI Score:	I An C
fort water White harmon by managers and	18/06	Monroe		an emiller	Complete		WILL SCORE.	
	ate (20 po					Su	bstrate Score:	105
Check 1	Predominant	Pool & 1 P	Predominant Riff	le [Substrate Quality (c		heck 2 and AVERAG	E
	that are prese	*********	P=Pool, R=			Substrate Ori	igIn	
Predominant	Pres	sent P	redominant	Present	Limestone(1)	☐ Hardpan(0)	Lacustrine(0)
PR		R	PR	PR	[_]Tills(1)	Sandstone(0) [] Shale(-1)	
,		112	Hardpan(4		Wetlands(0).	Rip/Rap(0)	Coal fines(-	2)
[] [] Boul			Detritus(3	y	Silt Cover	ec r	Embeddedness	
☐ ☐ Cobb		175	Muck(2)		Slit heavy(-		Extensive(-2)	
∏ ⊠Grave □ □Sand		TX	[Silt modera	16.00 March 10.00	☐ Moderate(-1) ☐ Low/Normal(0)	
∑ Sand		16 2 0	☐ ☐ Siddge(1)		Silt free(1)	۾ ره	None(1)	
NOTE: Ignore	7.7	ating from	F-1000000000000000000000000000000000000	substrates pre	100 to 10			
sources; scor			The state of the s	ments:	F5 +41.5	+1 16	.<	
2-Instrage	m Cover /	20 noin	ıts maximu	ــــــــــــــــــــــــــــــــــــــ	191113			/ 2 1 \
			ito maximu	KIII.	₩ <u></u>		n Cover Score:	
Undercut	ALL that appl	6/23/4/52	Dan seete/01	Oxbows(1	Co.		y 1, or 2 and AVERA sive >75% (11)	GE)
	nanks() ing vegetation		Deep pools(2) Rootwads(1)		acrophytes(1)	20072000	rate 25-75% (7)	
	in slow water)	20 N	Boulders(1)	22/4/7/16	woody debris(1)		e 5-25% (3)	
Rootmats	31	mments:		Y-7, -4			y absent <5% (1)	38
10 Marie	Morpho	logy (2	() /check only	one per catego	ory, OR two and AVE		Channel Score:	7-7-
Sinuosity	Develo		Channelizati		Stability	Modifications/O	ar and a second	17
High (4)		illent (7)	None (6)	<u> </u>	High (3)	Snagging	[]Impound	
Moderate	A.C. 20010 A.C.		Recovered	(4)	SModerate (2)	Relocation	Islands	
Low (2)	Fair	30.0000	Recovering	FE1 . 35		10		
5.65 declaration 5070,			Inecoveriii	g (3)	Low (1)	Canopy Rem	oval Leveed	
□ None (1)	Poor	E. 1954)	5300000 Al	g (3) no recovery (1)	Low (1)	☐ Canopy Rem ☐ Dredging	ovalLeveed Bank sha	plng
None (1)	[]Pool	E. 1954)	5300000 Al	STOREST TO MAKE THE	60 mm 1840 60 mm 1840 m 1840 mm 1840 mm	Dredging .		plng
Comments:	3	(1)	Recent or	no recovery (1)		☐Dredging ☐One side cha	☐Bank sha nnel modifications	plng
Comments: 4-Riparian	n Zone &	(1) Bank E	Recent or rosion (10	no recovery (1) points ma	ximum)	□Dredging ☑One side cha	Bank sha nnel modifications Riparian Score:	Plng
Comments: 4-Riparian	n Zone &	(1) Bank E	Recent or rosion (10 am (For each or	no recovery (1) points ma	ximum) only one per bank, (□Dredging ☑One side cha	Bank sha nnel modifications Riparian Score:	ping
4-Ripariar Left/Right	n Zone & banks tooking	Bank E downstre	Recent or rosion (10 am (For each or	points ma ategory, check biain quality (pa	ximum)	□Dredging ☑One side cha	Bank sha unnel modifications Riparian Score: and AVERAGE).	ping 8
4-Ripariar Left/Right Riparian wid L R (per ba	n Zone & banks looking th ank)	Bank E downstre Erosig	rosion (10 am (For each of on/Runoff-Flood) (most predomin forest, Swamp (3	points ma ategory, check blain quality (pa ant per bank)	ximum) only one per bank, (ast 100 ft Riparlan) LR	One side cha One side cha R OR two per bank on Tillage (1)	Bank shannel modifications Riparian Score: and AVERAGE). Bank Erosion L R (per bank) None or little	<u> </u>
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□『ライイル Sample # bioSam		Studios (OHEI)(Qu	alitative Habitatiev	aluation Index)
Surveyor Sample Date	County	Macro SampleType	[] Habitat	QHEI Score:
			Complete	L
Impacts/Miscella	ineous	iii.		8
	pacts (Check all that apply)	³ (1	Miscellaneous QHEI Inf	TA CA COMPANY
☐ None ☐ Industrial ☐ WWTP ☐ Agricultural ☐ Livestock ☐ Silviculture ☐ Construction	☐ Suburban ☐ Channelization ☐ Riparian Removal ☐ Flow Alteration ☐ CSOs ☐ Mining ☐ Landfills	Subjective rating Aesthetic rating Canopy Cover (% General QHEI Note	g (1-10): 9 % Run: 7 % Glide: 7 % Open): 20 % Pool: 4	of stream? Um
Urban Runoff	□ Natural			\$ in the second
Pollution Impact Comm	ents:		30 N	***
SR37 MB	South of the state	we time		



Secs-565 b, c, d

	Stream Name	Location	
	GRIFFEY CRE		4
veyor Sample Date Count	The state of the s	eType Habitat	QHEI Score: 37
	mrac (maximum)	Johnson	Substrate Score: 1
		Isubatrata Quality John	AND THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS
Check 1 Predominant Pool		Substrate Quality (Cire	ck only 1, or check 2 and AVERAGE) Substrate Origin
Check all that are present	P=Pool, R=Riffle Predominant Present	Limestone(1)	Hardpan(0) Lacustrine(0)
P R P R	PR PR		Sandstone(0) Strale(-1)
Bldrs/Slabs(10)	Hardpan(4)		Rip/Rap(0) Coal fines(-2)
Boulders(9)	Detritus(3)	Silt Cover	Embeddedness
Cobble(8)	□ □ Muck(2)	Silt heavy(-2)	①Extensive(-2)
Gravel(7)		Silt moderate(
Sand(6)		Silt normal(0)	Low/Normal(0)
Bedrock(5)	from point 4 substrates p	Silt free(1)	None(1)
ces; score based on natural			
	outside I	+2 = 6 (-5)	
nstream Cover (20 p	points maximum	- 1-40	Instream Cover Score: 8
pe (check ALL that apply)		Sales State	unt (check only 1, or 2 and AVERAGE)
Undercut banks(1)	Deep pools(2) Oxbows		Extensive >75% (11)
Overhanging vegetation(1)		macrophytes(1) d woody debris(1)	Moderate 25-75% (7) ✓ Sparse 5-25% (3)
Shallows(in slow water)(1) Rootmats(1) Comme		a woody debris(1)	Nearly absent <5% (1)
	(213		
Channel Morphology	y (20) (check only one per categ	ory, OR two and AVERA	GE Channel Score: 5
nuosity Development			odifications/Other
High (4) Excellent			Snagging Impound
Moderate (3) Good (5)	Recovered (4)		Relocation Islands
Low (2) Fair (3)	[Pacauaring (3)		, 2 to 10 to 2 to 10 to 2 to 10 to 2 to 10
	Recovering (3)		Canopy Removal Leveed
None (1) Poor (1)	Recent or no recovery (1)	Dredging Bank shaping
None (1) ☑ Poor (1)	Recent or no recovery (1)	Dredging Bank shaping One side channel modifications
None (1) Poor (1) Iments: Riparian Zone & Ban	Recent or no recovery (aximum)	Dredging Bank shaping One side channel modifications Riparian Score: 5
None (1) Poor (1) hments: Riparian Zone & Ban Left/Right banks looking dow	Recent or no recovery (** nk Erosion (10 points manustream (For each category, check	aximum) k only one per bank, OR	Dredging Bank shaping One side channel modifications Riparian Score: 5 two per bank and AYERAGE).
None (1) Poor (1) hments: Riparian Zone & Ban Left/Right banks looking dow parian width	Recent or no recovery (** **Recent or no recent	aximum) k only one per bank, OR past 100 ft Riparian)	Dredging Bank shaping One side channel modifications Riparian Score: 5 two per bank and AYERAGE). Bank Erosion
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None (1) Poor (1) Imments: Riparian Zone & Ban Left/Right banks looking dow parian width R (per bank) Wide >50m (4) Moderate 10-50m (3)	Recent or no recovery (** **Recent or no recovery (** **Include the control of the	aximum) k only one per bank, OR past 100 ft Riparian) L R Conservation	Dredging Bank shaping One side channel modifications Riparian Score: 5 two per bank and AYERAGE). Bank Erosion L R (per bank) Tillage (1) None or little (3) strial (0) Moderate (2)
None (1) Poor (1) Imments: Riparian Zone & Ban Left/Right banks looking dow parian width R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2)	Recent or no recovery (** **Recent or no recovery (** **Ink Erosion (10 points mainstream (For each category, check erosion/Runoff-Floodplain quality (** **Recent or no recovery (** **Ink Erosion (10 points mainstream (For each category, check erosion/Runoff-Floodplain quality (** **Recent or no recovery (** **Ink Erosion (10 points mainstream (Forest, Category) (Fo	aximum) k only one per bank, OR past 100 ft Riparian) L R Conservation Urban or Indu	Dredging Bank shaping One side channel modifications Riparian Score: 5 two per bank and AYERAGE). Bank Erosion L R (per bank) Tillage (1) None or little (3) strial (0) Moderate (2) truction (0) Heavy/Severe (1)
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Riparian Zone & Ban Left/Right banks looking down Riffle >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments Pool/Glide Quality (ax pool depth (check one) Left/Im (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) Text-align: center; Riffle/Run Quality (8) Senerally>10cm, Max>50cm (4) Senerally>10cm, Max>50cm (3) Senerally 5-10cm (1)	Recent or no recovery (** RK Erosion (10 points material (** Recent and the property of the points of the property of the points of the property of the points of the point of the points of the poi	aximum) k only one per bank, OR past 100 ft Riparian) L R	Dredging
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None (1) Proor (1) Imments: Riparian Zone & Ban Left/Right banks looking dow parian width R (per bank) Wide >50m (4) Moderate 10-50m (3) Very narrow <5m (1) None (0) Comments Pool/Glide Quality (ax pool depth (check one) 1 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) 1 <<0.2m (pool=0) Com Riffle/Run Quality (8 Generally>10cm, Max>50cm (4 Generally>10cm, Max<50cm (3 Generally<5cm (riffle=0)	Recent or no recovery (** **Recent of the content	aximum) k only one per bank, OR past 100 ft Riparian) L R Gonservation Urban or Indu Mining, Const Moen Pasture Pool/Run/Riffle c Eddies (1) Fast (1) Moderate (1) Slow (1) OR two and AVERAGE Riffle construction Riffle con	Dredging Bank shaping One side channel modifications Riparian Score: 5 two per bank and AVERAGE). Bank Erosion L R (per bank) Tillage (1) None or little (3) Instrial (0) Moderate (2) Inuction (0) Meavy/Severe (1) /Rowcrop (0) Pool/Glide Score: 8 urrent velocity (check all that apply) Torrential (-1) Intermittent (-2) No pool (0) Riffle/Run Score: 6 e/run embeddedness Extensive (-1) Normal/Low (1) Moderate (0) None (2) No riffle (0) Gradient Score: 10

ample # bioSa	mple# S	tream Name		Location	W. S. C.	The state of the s
65 b, c, d	Lesia I	GRIFFEY			@ SR 37	
urveyor Sample Date	County	Mag	cro SampleType	Habitat Complete	QHEI Sco	ore:37
		<u>.</u>		Complete		
npacts/Miscell	aneous	124,4	Sand Charles			19-1
Major Suspected In	npacts (Check	all that apply)		Miscellaneous Q	HEI Information	THE PARTY
☐ None	Suburb	1421	Subjective ratio	ng (1-10): 5 % R	iffle: O Is reach rep	resentative
Industrial	Channe		Aesthetic ratio	%1	Run: 80 of stream?	[Ues]
□ WWTP		Removal	He I	70 0	lide: 10	J:. ' :
Agricultural	- Flow Al	teration	Canopy Cover (Pool: 10	100
Livestock Silviculture	☐ CSOs ☐ Mining	4 15 6	General QHEI Not			75.00
☐ Construction	Landfill		Substrate v	revy loose, s	hifty	141.57
Urban Runoff				J		3,775,A
Pollution Impact Com	Company of the Compan			Alexander of		tary of again
				40700 - 51 - 10	earth, a carrier and a re-	TOURS INSURANT
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Alger 4	-3%	11 4 1	! ed	404 12 - 124	414.5	
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	The state of the s	som Creek Location	
Surveyor Sample Date Coul	inty Macro Sample	eType Habitat	QHEI Score: 34,
Ku 179/2005 N	logroe	Complete	34,
1-Substrate (20 point	s maximum)		Substrate Score: 3
Check 1 Predominant Poo	ol & 1 Predominant Riffle	Substrate Quality (check of	only 1, or check 2 and AVERAGE)
Check all that are present	P=Pool, R=Riffle		bstrate Origin
Predominant Present	Predominant Present	Limestone(1)	lardpan(0) Lacustrine(0)
PR PR	PR PR	Tills(1)	andstone(0) Shale(-1)
☐ Eldrs/Slabs(10) ☐ ☐	Hardpan(4)	A Company of the Control of the Cont	ip/Rap(0)
Boulders(9)	Detritus(3)	Silt Cover	Embeddedness
Cobble(8)		Silt heavy(-2)	Extensive(-2)
Gravel(7)	Silu(2)	Silt moderate(-1)	Moderate(-1) Low/Normal(0)
Bedrock(5)	Artificial(0)	Slit free(1)	None(1)
OTE: ignore studge originating			ETWORLY.
ources, score based on natura		5+2-7-10	THE STATE OF TAKE
2-Instream Cover (20	points maximum	Var a	Instream Cover Score: 8
Type (check ALL that apply)		Amount	(check only 1, or 2 and AVERAGE)
Undercut banks(1)	Deep pools(2) Oxbows		Extensive >75% (11)
Overhanging vegetation(1)		macrophytes(1)	Moderate 25-75% (7)
[1]Shallows(in slow water)(1)	☐Boulders(1) ☐Łógs and	d woody debris(1)	☐Sparse 5-25% (3)
Rootmats(1) Comm	ents:		Nearly absent <5% (1)
High (4) Development High (4) Excellen Moderate (3) Good (5) Low (2) Fair (3)	it (7) None (6) Recovered (4)	☐ High (3) ☐ Sn	agging Impound location Islands nopy Removal Leveed
Low(2)Fair (3)	Recovering (3)	The state of the s	nopy Removal Leveed edging Bank shaping
	handliged - very unit		e side channel modifications
The second secon	nk Erosion (10 points ma		
		VERTICAL PROPERTY OF THE OWNER.	Riparian Score: 6.
A CAMPAGE CONTRACTOR OF THE CAMPAGE CONTRACT	wnstream (For each category, check Erosion/Runoff-Floodplain quality (p		Per bank and AVERAGE). Bank Erosion
CONTROL OF THE PARTY OF THE PAR	L R (most predominant per bank)		L R (per bank)
	Forest, Swamp (3)	Conservation Till	
Moderate 10-50m (3)	Shrub or Old field (2)	☐ ☐ Urban or Industri	사이 가는 이 집에 되었다. 그는 장프로그램 그래프로 있는 것이 아니라도 사이를 가셨다고 있다면 하다.
1 (-14-20111 (3)			di [U] moderate [2]
Narrow 5-10m (2)	Residential, Park, New field (1)	Mining, Construc	
	Residential, Park, New field (1)		tion (0) Heavy/Severe (1)
Narrow 5-10m (2) [Very narrow <5m.(1) [Fenced pasture (1)		tion (0) Heavy/Severe (1)
Narrow 5-10m (2)	Fenced pasture (1)		tion (0) Heavy/Severe (1)
Narrow 5-10m (2) Very narrow <5m.(1) None (0) Commen a-Pool/Glide Quality Max pool depth (check one)	Tenced pasture (1) its: (12 points maximum Morphology (check only one,	Pool/Run/Riffle curre	tion (0) Heavy/Severe (1) wcrop (0) Pool/Glide Score: Sent velocity (check all that apply)
Narrow 5-10m (2) Very narrow 55m (1) None (0) Commen a-Pool/Glide Quality Max pool depth (check one)	Fenced pasture (1) // Sts: (12 points maximum Morphology (check only one, OR check two and AVERAGE)	Pool/Run/Riffle curn	Pool/Glide Score: Sent velocity (check all that apply)
Narrow 5-10m (2) Very narrow 5-10m (2) None (0) Commen a-Pool/Glide Quality Max pool depth (check one) (5) 1m (6) 0.7-1m (4)	Fenced pasture (1)	Pool/Run/Riffle curn Eddies (1) Fast (1)	Pool/Glide Score: Sent velocity (check all that apply) Torrential (-1)
Narrow 5-10m (2) Very narrow <5m.(1) None (0) Commen a-Pool/Glide Quality Max pool depth (check one)	Fenced pasture (1) // Sts: (12 points maximum Morphology (check only one, OR check two and AVERAGE)	Pool/Run/Riffle curn	Pool/Glide Score: Sent velocity (check all that apply)
Narrow 5-10m (2) Very narrow <5m.(1) None (0) Commen None (0) Commen A-Pool/Glide Quality Max pool depth (check one) S1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1)	Tenced pasture (1) its: (12 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2) Pool width = riffle width (1)	Pool/Run/Riffle curre Eddies (1) Fast (1) Moderate (1)	Pool/Glide Score: Sent velocity (check all that apply) Torrential (-1) Intermittent (-2)
Narrow 5-10m (2)	Fenced pasture (1)	Pool/Run/Riffle curre Eddies (1) Fast (1) Moderate (1) Slow (1)	Pool/Glide Score: Sent velocity (check all that apply) Torrential (-1) Interstitial (-1) Intermittent (-2) No pool (0)
Narrow 5-10m (2) Very narrow <5m.(1) None (0) Commen a-Pool/Glide Quality Max pool depth (check one) S1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <	Fenced pasture (1) Its: (12 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2) Pool width = riffle width (1) Pool width < riffle width (0) mments: (8) (check only one per category, Riffle/run substrate	Pool/Run/Riffle curre Eddies (1) Fast (1) Moderate (1) Slow (1) OR two and AVERAGE	Pool/Glide Score: Sent velocity (check all that apply) Torrential (-1) Intermittent (-2)
Narrow 5-10m (2) Very narrow 55m (1) None (0) Commen a-Pool/Glide Quality Max pool depth (check one) fm (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <	Fenced pasture (1) Its: (12 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2) Pool width = riffle width (1) Pool width < riffle width (0) mments: (8) (check only one per category, Riffle/run substrate (4) Stable-e.g. cobble, bo	Pool/Run/Riffle curre Eddies (1) Fast (1) Moderate (1) Slow (1) OR two and AVERAGE) Riffle/ru	Pool/Glide Score: Sent velocity (check all that apply) Torrential (-1) Interstitial (-1) Intermittent (-2) No pool (0) Riffle/Run Score: Sent velocity (check all that apply) Torrential (-1) Intermittent (-2) No pool (0)
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Namew 5-10m (2) Very narrow 5m.(1) None (0) Commen a-Pool/Glide Quality Max pool depth (check one) 1m (6) 0.7-1m (4) 0.2-0.4m (1) <0.2m (pool=0) Composition of the check one) Ciffle/Run Quality (Check one) Generally-10cm, Max>50cm (1) Generally-10cm, Max<50cm (1)	Fenced pasture (1) 1.5 Its: Its: Morphology (check only one, OR check two and AVERAGE)	Pool/Run/Riffle curre Eddies (1) Fast (1) Moderate (1) Slow (1) OR two and AVERAGE Riffle/run Pool/Run/Riffle curre Rate (1) Slow (1) Riffle/run	Pool/Glide Score: Sent velocity (check all that apply) Torrential (-1) Interstitial (-1) Intermittent (-2) No pool (0) Riffle/Run Score: Sent velocity (check all that apply) Torrential (-1) Intermittent (-2) No pool (0)
Narrow 5-10m (2) Very narrow 55m (1) None (0) Commen a-Pool/Glide Quality Max pool depth (check one) 1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <	Fenced pasture (1) 1.5 Its: Its: Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2)	Pool/Run/Riffle curre Eddies (1) Fast (1) Moderate (1) Slow (1) OR two and AVERAGE Riffle/run Pool/Run/Riffle curre Rate (1) Slow (1) Riffle/run	Pool/Glide Score: Sent velocity (check all that apply) Torrential (-1) Interstitial (-1) Intermittent (-2) No pool (0) Riffle/Run Score: Sent velocity (check all that apply) Riffle/Run Score: No pool (0)
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Sample # bioSar		to the state of th	Location		-
38/c/e	Bea		ek :	2 5837	ا
Surveyor Sample Date	County	Macro Sam	PipleType Habitat Complete	QHEI Score: 34.7	3
Impacts/Miscell	Manroe		complete		
impacisimiscen	arieous	18 Sec. 3 6	1 2 3 3 4		
Major Suspected Im	pacts (Check all that a	apply)	Miscellaneous C	HEI Information	
☐ None ☐ Industrial ☐ WWTP ☐ Agricultural ☐ Liveslock ☐ Silviculture	☐ Suburban. ☐ Channelization ☐ Riparian Remo ☐ Flow Alteration ☐ CSOs ☐ Mining	val Aes	withetic rating (1-10): 3 % (20) Py Cover (% Open): 20 % I QHEI Notes:	Run: 80 of stream? Ues Silide: 15	
Construction	Landfills	ver	y homogeneous su	ubstrate + marphology	
Urban Runoff	Natural	11000	M H. K		
Pollution Impact Comm	ents:		10 / 10 m A . 1 / 10 A		
		III	A Commence of the second second	A Committee of the second	ليد
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in the Committee of Section 1889.

OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

I I	Sample #		bioSample #		Stream Name			Location		
-	\$25		2008-201	12/20/05	UT Bryan		ee /	West	5R 37	
1	Surveyor	Sample Date	County	Mad	cro Sample Typ	pe	⊠ Habitat	OHET	Score:	55.5
	KSS/DEW	4/26/12	Monroe				Complete	QIILL.	Score.	55.5
	BSTRATE O	estimate % and	redominant substrat check every type pro	e TYPE I esent IER TY	AND AND ASSESSMENT	ORI	Check ONE (O		ge) QUALITY	
PREDOMINA		PRESENT TOTAL %	PREDOMINANT	PRE	SENT TOTAL %					
PR	LDR/SLABS[1	01 🗆 🗆	P R HARDPAN				TONE [1]	S HE	AVY [-2] ODERATE [-1	1
$\Box \Box B$	OULDER [9]		☐☐ DETRITUS	[3] 🖾	🛛 _5_ 🗆 V	VETLA	NDS[0]	FX NO	RMAL [0]	Substrate
	OBBLE [8] RAVEL [7]	00 65	☐☐ MUCK[2]				PAN [0] STONE [0]	'□ FR	EE[1]	
ØD S	AND [6]	DD <u>Z0</u>	☐ ☐ ARTIFICIA	L[0] 🗆	□ <u> </u>		AP[0]		TENSIVE [-2	
	EDROCK [5]	7050					TRINE[0]		DERATE [-1	-
NOMB	EK OF BEST		more [2] sludge fi less [0]	rom poir	nt-sources) 🗆 S	HALE	[-1] TNES [-2]		RMAL[0] NE[1]	Maximum 20
Comm		13+1	- 2 725h					5		
			esence 0 to 3 and es					or if more	AMOUN	
			ighest quality or in s g., very large bould					Check	ONE (Or 2 &	
that is st	able, well deve		deep/fast water, or		ell-defined, functio				ENSIVE > 7	
% Amour	UNDERCUT BA	ANKS[1]	% Amount POOLS	> 70cm	% Amount OXBO	OWS. E	BACKWATERS[1		DERATE 25 - RSE 5 - < 25	
5 1	OVERHANGIN	IG VEGETATION [1	1 15 Z ROOTV	VADS[1] O AQUA		IACROPHYTES [:] 🗆 NEA	RLY ABSENT	「 <5%[1]
	ROOTMATS [1	N SLOW WATER) .1	[1] O BOULD	EKO[1]	10 T rocs	SORW	OODY DEBRIS	ıj	Cov Maximu	
Comm		,								20
			neck ONE in each ca							
SINU	OSITY H[4]	DEVELO	PMENT LENT[7]		INELIZATION IE[6]		STABI			
☐ MOI	DERATE[3]	☑ GOOD	[5]	X REO	OVERED[4]		☐ MOD	ERATE [2]	Chann	
☐ LOV	/[2] IE[1]	FAIR [3	[1]		OVERING [3] ENT OR NO RECOV	VERY [[1] KLOW	[1]	Maxim	20 13
Comm	ents	444 46	141							
4] BA	NK EROSIC	ON AND RIPA	RIAN ZONE Che	eck ONE	in each category f	for EAC	CH BANK (Or 2 pe	r bank & av	erage)	
	right looking downs	stream L R RIP	ARIAN WIDTH	LR	FLOOD PLAIN FOREST, SWAMP			R CONS	ERVATION TIL	LACETT
L R N	ONE/LITTLE [ERATE 10-50m [3]		SHRUB OR OLD F				NORINDUST	
$\Box\Box$ M	ODERATE[2]	□ X NARE	ROW 5-10m [2]		RESIDENTIAL, PA				NG/CONSTRU	
NX H	EAVY/SEVERE		NARROW[1]		FENCED PASTURE, F	ROWO	ROP [0] past 10	e predomina Om riparian	ant land use(s) Riparia	Section 1
C		1+3+1,5							Maximu	m 2,3
51 PO			RUN QUALITY	,						10
MAX	IMUM DEP	TH CHAN	NEL WIDTH				LOCITY	Owner, and a second	Recreation Po	
	ONE (ONLY!)		E (Or 2 & average) IDTH > RIFFLE WIL	וכווות			at apply SLOW[1]	(Cin	de one and com Primary C	
	7-<1m[4]		DTH = RIFFLE WIL		☐ VERY FAST		☐ INTERSTIT	[AL[-1]	☐ Secondary	
	4-<0.7m[2] 2-<0.4m[1]		IDTH < RIFFLE WIL	ЛН[0]	☐ FAST[1] MODERATE	111	☐ INTERMIT		Poo	The second second
	0.2m[0]						for reach – pools		Maximu	COLOR TO THE PARTY OF THE PARTY
Comm	ents	06m 2+1					ALEKSY SYNSON BYSESAS			12
	ate for function fle-obligate spe		as must be large end	State of the State	support a population			□ NC	RIFFLE [met	ric=01
	E DEPTH	RUN D	EPTH I	RIFFL	E/RUN SUBS	TRAT		/RUN EI	MBEDDED	THE RESIDENCE OF THE PARTY OF T
	TAREAS > 100		MUM > 50cm [2]					NONE [2]	pier	0/5
	TAREAS5-10 TAREAS<5a		MUM < 50cm [1])		D, STABLE (e.g., Lai STABLE (e.g., Fine (Sand)[0]	LOW [1] MODERAT	Riffl E[0] Ri	e/ un 7
	[metr	ic=0]	4 (E[-1] Maximu	
61 GR	ADIENT (8	1.1	☐ VERY LOW -	LOW [2	-4] %PO	OL:	20 %GLI	DE:	Gradien	8 L
5771		· · · · · · · · · · · · · · · · · · ·	MODERATE [6-10]					Maximu	
DR	AINAGE AI	REA (0.70 mi²)	☐ HIGH-VERY	HIIGH [10-6] %RU	וא: [(S) %RIF	rLE:[/5	1	.0
				_						TDEM 07/06/10

OHW = 15' x 1,7'

	COMMENT	-		owo	Biological Stu	idies QHEI	(Qualitative	e Habitat Evaluation Index)	
A-CANOP	Y	B-	AESTHETICS			C-REC	REATION	D-MAINTENANCE	E-ISSUES
□ >85%-	Open		Nuisance algae		Oilsheen	Area	Depth	☐ Public ☐ Private	□ WWTP □ CSO □ NPDES
55%-<	85%		Invasive macrop	hytes 🗆	Trash/Litter	Pool: □ > 10	00 ft² □ > 3 ft	☐ Active ☐ Historic	☐ Industry ☐ Urban
□ 30%-<	55%		Excess turbidity		Nuisance odor			Succession: Young Old	☐ Hardened ☐ Dirt & Grime
☐ 10%-<	30%		Discoloration		Studge deposits			☐ Spray ☐ Islands ☐ Scoured	☐ Contaminated ☐ Landfill
□ <10%-	Closed		Foam/Soum		C90s/990s/Outfalls	5		Snag: ☐ Removed ☐ Modified	BMPs: Construction Sedimen
١	1							Leveed: One sided Both banks	☐ Logging ☐ Imigation ☐ Cooling
Looking testes	#π (> 10m, 3 read	inas	< 10m, 1 reading in	middle); R	ound to the nearest who	e percent		☐ Relocated ☐ Cutoffs	Erosion: Bank Surface
3-	Left		Middle	Right	Total Avera			Bedload: ☐ Moving ☐ Stable	☐ False bank ☐ Manure ☐ Lagoo
% open	40 %		60 %	80%				☐ Armoured ☐ Stumps	□ Wash H₂O □ Tile □ H₂O Table
	10		60	00	00			☐ Impounded ☐ Desiccated	Mine: □ Acid □ Quarry
	\times		\times	X				☐ Flood control ☐ Drainage	How: □ Natural □ Stagnant □ Wetland □ Park □ Golf □ Lawn □ Home □ Atmospheric deposition

IDEM		WQ Biologic	cal Studies QI	V AT 1.7		itat Evalua	The state of the s	
-	Sample #	345d.e	bioSample #		HL India	in Creek	Location	
1	Surveyor	Sample Date	County		ample Type	M Habitat		
de	165 080	14/25/12	Morgan			Complete	QHEI Score:	52,5
47 00								
1] 50	BSTRATE		edominant substrate check every type pre		ř	Check ONE (Or 2 & average)	
PREDOMINA	BEST TYPE			ER TYPES PRESENT TO	OTAL %	IGIN	QUALITY	
PR	DD/CI ADCIA	PR	P.R.	P R	S TIUS	STONE[1]	S HEAVY [-2] IN MODERATE [-1	1
	LDR/SLABS [1: OULDER [9]		HARDPAN[4	31 🖾 🗆		ANDS[0]	L NORMAL[0]	Substrate
$\Box\Box$ α	OBBLE[8]		□□ MUCK[2]	00 _	HARD	PAN[O]	' □ FREE[1]	
	RAVEL[7] AND[6]	00 70	□□ SILT[2] □□ ARTIFICIAL			STONE[0] PAP[0]	ECTENSIVE [-2	19
	EDROCK[5]		(Score natural			TRINE[0]	MODERATE [-1	
NUMBE	ER OF BEST		more [2] sludge fro		es) 🗆 SHALE	[-1]	NORMAL[0]	Maximum
Comm	onte	₩3 or l	less [0]		□ COAL	FINES [-2]	§ □ NONE[1]	20
		VER Indicate pre	sence 0 to 3 and est	imate percent	: 0-Absent: 1-Ve	ery small amount	s or if more common of ma	rginal
quality; 2	2-Moderate am	ounts, but not of hi	ighest quality or in sr	mall amounts	of highest quality	; 3-Highest	AMOUNT	Г
			g., very large boulde				Check ONE (Or 2 & a	
% Amoun		loped root wad in d	leep/fast water, or do	7.7	Amount	iois.)	MODERATE 25-	
	UNDERCUT BA	and straightful and beautiful to the country of the Print	40 Z POOLS>	70cm [2]_		BACKWATERS [
		G VEGETATION [1] N SLOW WATER) [:			AQUATICN	MACROPHYTES [A STATE OF THE PARTY OF THE PAR
	ROOTMATS [1]			الماص	Z E LOCO OICE	OOD I DEDICED	Maximu	4 1
Comm	onte	-					2	0
House Some	Invitate services	BRUOLOGY -		10.00				
SINUC		DEVELO	eck ONE in each cate	egory (Or 2 & CHANNELI		STABI	LITY	
☐ HIGH	1[4]	☐ EXCELLE	ENT[7]	NONE[6]		☐ HIGH	1[3]	
☐ MOD	ERATE[3]	GOOD [3		RECOVERE		□ LOW	PERÂTE [2] Chann Maximu	
☐ NON		POOR[NO RECOVERY		2	2 1 2
Comme	ents							
4] BAN	IK EROSIO	N AND RIPAR	IAN ZONE Check	k ONE in each	category for EAC	CH BANK (Or 2 pe	er bank & average)	
	right looking downst				D PLAIN QUA		R	
	EROSION NE/LITTLE[3	WIDE:			,SWAMP[3] OROLD FIELD[3		DE CONSERVATION TILL URBAN OR INDUSTR	
DE MC	DERATE[2]	□□ NARRO	DW 5-10m [2]				I MINING/CONSTRUC	
□□ HE	AVY/SEVERE	[1] XX VERY	IARROW[1]		PASTURE[1]		e predominant land use(s)	
	2.5	HI TO NONE	[0]	□ □ OPEN P	ASTURE, ROWO	KOP[0] base to	00m riparian. Riparian Maximum	
Comme								
		ND RIFFLE/R			CUDDENT VE	LOCTTY	Domestica Dat	contial
	MUM DEPT ONE (ONLY!)		(Or 2 & average)		CHECK ALL that		Recreation Pot (Circle one and comm	
图 >1	lm[6]	Ø POOLWID	TH>RIFFLE WIDT		ORRENTIAL[-1]	☑ SLOW[1]	☐ Primary Cor	ntact
	-<1m[4]	The second secon	TH = RIFFLE WIDT		RYFAST[1] ST[1]	☐ INTERSTITE		Open Control of the C
	-<0.7m[2] -<0.4m[1]	□ POOL WID	TH < RIFFLE WIDT		ODERATE[1]	☐ INTERMITI		
□ <0).2m[0]				Control of the Contro	for reach - pools	and riffles. Maximum	
Comme		Luttilani Dast sussa	enuet ha large coour	h to cumport	n nonulation		17	
	e for functional cobligate speci		must be large enoug	neck ONE (Or :			NO RIFFLE [metri	c=0]
	DEPTH	. RUN DE			SUBSTRAT	E RIFFLE	/RUN EMBEDDEDN	
-	AREAS > 10cm		UM > 50cm [2])[2] 📙	NONE [2]	
	AREAS 5 - 10a AREAS < 5 am	MIXAM [1]	UM < 50cm [1]		E (e.g., Large Gra e.g., Fine Gravel, S		LOW [1] Riffle, MODERATE [0] Run	11
	[metric	=0]			37		EXTENSIVE [-1] Maximum	
Comme	nts		□ \ED\(1000 10	14/53 47	0/-0001-	0/017	8 8	
o] GKAI	DIENT (5		□ VERY LOW - LO ⋈ MODERATE [6 -		%POOL:	%GLII	OE: Gradient Maximum	
DRA.	INAGE ARE	and at	HIGH-VERY HI		%RUN:	70 %RIFF		10
		100-110						

OHW = 58' + 12'

IDEM 07/06/10

COM	IMENT _		OWQ Biological	Studies QHEI (Qualitative	Habitat Evaluation Ind	lex)	
% open	nd 10m, 3 readi Left 95 %	□ Excess turbidit□ Discoloration□ Foam/Soum	e	Area Pool: □ > 100	EATION Depth ft² □ >3 ft	D-MAINTENANCE Public Private Active Historic Succession: Young Old Spray Islands Scoured Snag: Removed Modified Leveed: One sided Both book Relocated Outoffs Bedload: Moving Stable Armoured Stumps Impounded Desiccated Flood control Drainage	i	E-ISSUES WWTP CSO NPDES Industry Urban Hardened Dirt & Grime Contaminated Landfill BMPs: Construction Sediment Logging Imigation Cooling Erosion: Manure Lagoon Wash H ₂ O Tile H ₂ O Table Mine: Acid Quany How: Natural Stagnant Wetland Park Golf Lawn Home Atmospheric deposition
Stream Drav	wing:	11	-					
June Charge	8.3	1 37	() Sol	N S S S S S S S S S S S S S S S S S S S	edly Say			
King Pourield		3a T			732			

See5-5350b, c, d

Sample # bloSample #	Stream Name	Locati	
	Jordan Creek	and the second s	137 bridge
Surveyor Sample Date County		The state of the s	QHEI Score:
10/30/2005 Mor		Complete	Le la
1-Substrate (20 points	maximum)	A SALE	Substrate Score:
Check 1 Predominant Pool &		Substrate Quality (che	eck only 1, or check 2 and AVERAG
Check all that are present	P=Pool, R=Riffle	acontain situating (cite	Substrate Origin
Predominant Present	A STATE OF THE PARTY OF THE PAR	Limestone(1)	The state of the s
P R P R	Predominant Present P R P R	Satills(1)	☐ Hardpan(0) ☐ Lacustrine(☐ Sandstone(0) ☐ Shale(-1)
Bldrs/Slabs(10)	Hardpan(4)	Wetlands(0)	Rip/Rap(0) Coal fines(-
Boulders(9)	Detritus(3)	Silt Cover	Embeddedness
Cobble(8)	Muck(2)	Sitt heavy(-2)	
Gravel(7)	Silt(2)	Silt moderate	
Sand(6)	Sludge(1)	Silt normal(0)	
Bedrock(5)	☐ ☐ Artificial(0) ☐ ☐	Silt free(1)	None(1)
			[]Hunc(i)
NOTE: ignore sludge originating fr sources; score based on natural s	which while the same of the sa		
vasa j secore buses dir matural si	ubstrates Comments:	+1 -4=1	2 2 2 2 3 3 3 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
2-Instream Cover (20 pe	oints maximum	100 100	Instream Cover Score:
Type (check ALL that apply)		Amo	ount (check only 1, or 2 and AVERA
Undercut banks(1)	Deep pools(2) Oxbows(20.5	Extensive >75% (11)
Overhanging vegetation(1)		nacrophytes(1)	Moderate 25-75% (7)
Shallows(in slow water)(1)		woody debris(1)	Sparse 5-25% (3)
Rootmats(1) Comment		300.0(1)	Nearly absent <5% (1)
	TANKY		
3-Channel Morphology	(20) (check only one per categorial	ory, OR two and AVERA	AGE) Channel Score:
Sinussity Development	Channelization	Stability M	lodifications/Other
High (4) Excellent (7	PT 1	High (3)	Snagging Impound
Moderate (3) Good (5)	Recovered (4)	Moderate (2)	Relocation Islands
Low (2) Fair (3)	Recovering (3)	Low (1)	Canopy Removal Leveed
None (1) Poor (1)	Recent or no recovery (1		
O	Recent of no recovery (1		
	to a tour		Dredging Bank shap
Lapreus 10	have been channelinge	d-?	One side channel modifications
4-Riparian Zone & Bank	The strike is written as the strike is the strike in the s	d-?	
4-Riparian Zone & Bank	Erosion (10 points ma	ximum)	One side channel modifications Riparian Score:
4-Riparian Zone & Bank	Erosion (10 points ma stream (For each category, check	xirnum) only one per bank, OR	One side channel modifications Riparian Score:
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width	Erosion (10 points ma stream (For each category, check oslon/Runoff-Floodplain quality (p	only one per bank, OR ast 100 ft Riparlan)	One side channel modifications Riparian Score: two per bank and AVERAGE). Bank Erosion
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) L	Erosion (10 points ma stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank)	only one per bank, OR ast 100 ft Riparian)	One side channel modifications Riparian Score: two per bank and AVERAGE). Bank Erosion L R (per bank)
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ero L R (per bank) L Wide >50m (4)	Erosion (10 points ma stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3)	only one per bank, OR ast 100 ft Riparian) L R Conservation	One side channel modifications Riparian Score: I two per bank and AVERAGE). Bank Erosion L R (per bank) Tillage (1) None or little (
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) UWide >50m (4) Moderate 10-50m (3)	Erosion (10 points ma stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3)	only one per bank, OR ast 100 ft Riparian) L R Conservation Urban or India	Riparian Score: Riparian Ripa
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) UWide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2)	Erosion (10 points mastream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1)	only one per bank, OR ast 100 ft Riparian) L R Conservation Urban or Indu	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1)	terosion (10 points mastream (For each category, check oslon/Runoff-Floodplain quality (programmer) Resolved (1) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1)	only one per bank, OR ast 100 ft Riparian) L R Conservation Urban or India	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ero L R (per bank) L Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments:	Erosion (10 points mastream (For each category, check oslon/Runoff-Floodplain quality (particle) (p	only one per bank, OR ast 100 ft Riparian) L R Conservation Urban or Indu	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ero L R (per bank) L Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments:	Erosion (10 points mastream (For each category, check oslon/Runoff-Floodplain quality (particle) (p	only one per bank, OR ast 100 ft Riparian) L R Conservation Urban or Indu	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ero L R (per bank) L Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1	terosion (10 points mastream (For each category, check pslon/Runoff-Floodplain quality (programmer) Response (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum	only one per bank, OR ast 100 ft Riparian) L R Conservation Urban or Indu	Riparian Score: Riparian Score
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1	Erosion (10 points mastream (For each category, check oslon/Runoff-Floodplain quality (particle) (p	only one per bank, OR ast 100 ft Riparlan) L R Conservation Urban or Indu Mining, Cons	Riparian Score: Riparian Rip
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6)	Erosion (10 points mastream (For each category, check oslon/Runoff-Floodplain quality (p. R. (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE)	only one per bank, OR ast 100 ft Riparlan) L R	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4)	terosion (10 points mastream (For each category, check pslon/Runoff-Floodplain quality (p) R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2)	only one per bank, OR ast 100 ft Riparian) L R Conservation Urban or Indu Mining, Cons Open Pasture Pool/Run/Riffle o Eddies (1) Fast (1)	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2)	stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (1)	only one per bank, OR ast 100 ft Riparian) L R	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1)	stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (1) Pool width < riffle width (0)	only one per bank, OR ast 100 ft Riparian) L R Conservation Urban or Indu Mining, Cons Open Pasture Pool/Run/Riffle o Eddies (1) Fast (1)	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ers L R (per bank) L Wide >50m (4) Moderate 10-50m (3) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1)	stream (For each category, check coslon/Runoff-Floodplain quality (p) R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (1) Pool width < riffle width (0) lents:	only one per bank, OR ast 100 ft Riparian) L R	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1)	stream (For each category, check coslon/Runoff-Floodplain quality (p) R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (1) Pool width < riffle width (0) lents:	only one per bank, OR ast 100 ft Riparian) L R	Riparian Score: Riparian Score: Riparian Score: Bank Erosion L R (per bank) Tillage (1) None or little (ustrial (0) Moderate (2) struction (0) Heavy/Severe e/Rowcrop (0) Pool/Glide Score: current velocity (check all that apph Torrential (-1) Interstitial (-1) Who pool (0)
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 9:2-0.4m (1) 5b-Riffle/Run Quality (8)	stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2) Pool width < riffle width (0) Intents:	only one per bank, OR ast 100 ft Riparian) L R	Riparian Score: Ripari
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) 5b-Riffle/Run Quality (8) Riffle/run depth (check one)	stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (1) Pool width < riffle width (0) sents: (check only one per category, 0 Riffle/run substrate	only one per bank, OR ast 100 ft Riparian) L R	Riparian Score: Riffle/Run Score: Riparian Score: Ripa
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Ers L R (per bank) L Wide >50m (4) Moderate 10-50m (3) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <0.2m (pool=0) Comm Sb-Riffle/Run Quality (8) Riffle/run depth (check one) Generally>10cm, Max>50cm (4)	stream (For each category, check coslon/Runoff-Floodplain quality (p) R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2) Pool width < riffle width (1) Pool width < riffle width (0) Items: (check only one per category, Ca	only one per bank, OR ast 100 ft Riparian) L R	Riparian Score: Riparian Score: Bank Erosion L R (per bank) Tillage (1)
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width Erg L R (per bank) L Wide >50m (4) Moderate 10-50m (3) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1) Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <0.2m (pool=0) Comm b-Riffle/Run Quality (8) Riffle/run depth (check one) Generally>10cm, Max>50cm (4) Generally>10cm, Max<50cm(3)	stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2) Pool width < riffle width (1) Pool width < riffle width (0) ents: (check only one per category, Cate	pool/Run/Riffle of Eddies (1) Fast (1) Pool (2) Pool (2) Pool (3) Pool (4) Pool (4) Pool (5) Pool (7) Pool	Riparian Score: Riparian Score: Bank Erosion L R (per bank) Tillage (1) Moderate (2) Struction (0) Heavy/Severe e/Rowcrop (0) Pool/Glide Score: current velocity (check all that apph Torrential (-1) Interstitial (-1) Interstitial (-1) Mo pool (0) Riffle/Run Score: fle/run embeddedness Extensive (-1) Normal/Low (1) Moderate (0) None (2)
4-Riparian Zone & Bank Left/Right banks looking downs Riparian width L R (per bank) Wide >50m (4) Moderate 10-50m (3) Narrow 5-10m (2) Very narrow <5m (1) None (0) Comments: 5a-Pool/Glide Quality (1 Max pool depth (check one) >1m (6) 0.7-1m (4) 0.4-0.7m (2) 0.2-0.4m (1) <	stream (For each category, check oslon/Runoff-Floodplain quality (p R (most predominant per bank) Forest, Swamp (3) Shrub or Old field (2) Residential, Park, New field (1) Fenced pasture (1) 2 points maximum Morphology (check only one, OR check two and AVERAGE) Pool width > riffle width (2) Pool width < riffle width (1) Pool width < riffle width (0) ients: (check only one per category, Cate	pool/Run/Riffle of Eddies (1) Fast (1) Pool (2) Pool (2) Pool (3) Pool (4) Pool (4) Pool (5) Pool (7) Pool	Riparian Score: Riparian Score: Bank Erosion L R (per bank) Tillage (1)
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